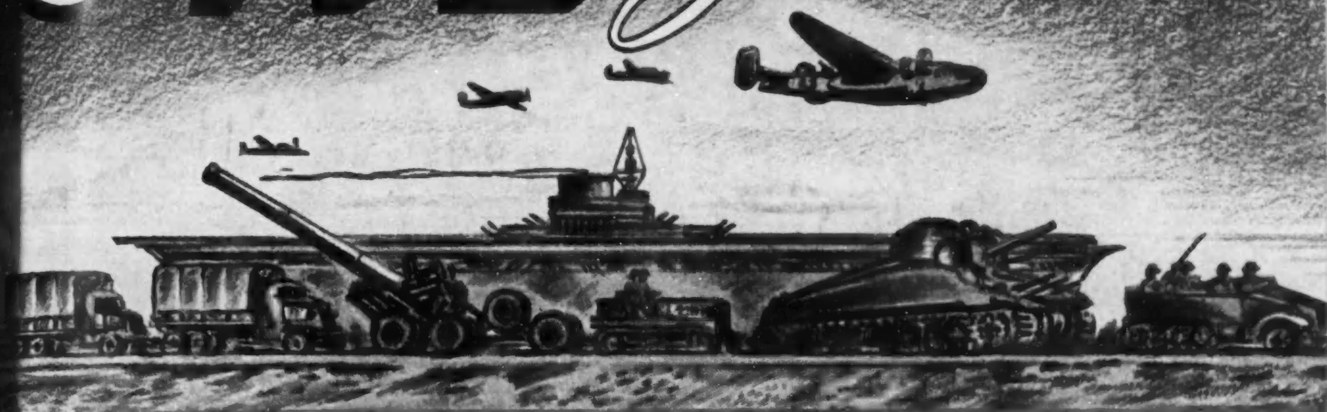
S·A·E Journal



MAY 1944

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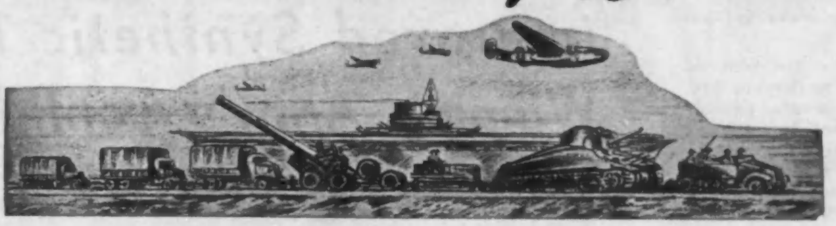

News of the **JUNE** *Issue*

By *Norman G. Shidle*

"... Our Tomorrow"

ONLY occasionally is a fine engineer a stirring speaker. Only occasionally is a military genius capable of moving phrases.

Gen. Douglas MacArthur, outstanding military strategist, is a blazing example of how these dissimilar qualities sometimes are combined. Every so often he makes even communiques stirring – a form of expression which, as commonly handled, probably marks an absolute low in the scale of creative writing and literary craftsmanship. More than a few of his brief statements and addresses may eventually find themselves in schoolbooks of the future.

Sometimes MacArthur's phrasing is strongly reminiscent of such prose masterpieces of Lincoln's Gettysburg Address . . . Take his 700-word response at the State Banquet held in his honor by Australia on March 17. In words applicable to all American soldiers fighting everywhere, he spoke of the men of his command who died in the Philippines. Those men, he said, "made the fight which saved this continent." Then he concluded:

> "With faith in their hearts and hope on their lips, they passed beyond the mists that bind us here.
>
> "Their yesterday makes possible our tomorrow."

The European invasion is coming up. More than half our male population within the 20-year span of military age is under arms. MacArthur's dramatic words again and again will burn grimly in our minds before Fortress Europe is cracked.

Air Transport Industry Preparing for Peacetime Transition to Big Business

THEY are saying in the air transport industry that the first 10 years of peace will be the hardest. It will be a period of transition and, for the commercial airplane, of economic determination. Wartime experiences and developments in air transportation must be applied to peacetime needs and progress in a world become suddenly air-minded in the midst of unsettlement.

"We must stretch our imagination and look far beyond what we thought was realizable before the war," Charles Froesch, chief engineer, Eastern Air Lines, Inc., will say in June *SAE Journal*. Admitting the difficulties and probable embarrassments of the prophet's role, Mr. Froesch will seek to predict trends, especially as they affect engineering and equipment.

Mr. Froesch will report that out of the war are coming operational experience, larger airplanes and engines, airport expansion, radio developments which will revolutionize air traffic control, and tremendous plane- and engine-manufacturing capacity.

He will predict that air transport must pass through a transition phase of changing from wartime mobilization to commercial operations, and may use this three- to four-year period in replacing equipment. An intermediate period, comprising four to six years of readjustment and expansion, is seen as coming next, with manufacturers producing the needed and modernized equipment. Finally is seen a development era during which large-scale operations establish the air transport industry as big business.

Equipment needs will be said to reveal themselves particularly in the intermediate period and to call for five types of planes and service:

- Feeder Service, with small bimotor planes carrying passengers, mail, and express on 25-30-mile flights between communities and to main-line transfer points.
- Local Schedule, with larger bimotor planes making 100-200-mile flights accommodating passengers and cargo locally, and linking feeder service facilities.
- Limited-Stops Service, with larger and faster bimotor or quadrimotor planes and sleeper planes operating from modern airports carrying maximum payloads at high speed.
- Long-Range Operation, with quadrimotor planes of maximum size and speed making 1000-mile-plus flights over land and sea, carrying large cargoes, offering de luxe day and night passenger service.
- Cargo Service, with bimotor "flying box cars" carrying merchandise.

Watch For Dynamic, Illustrated Story of The SAE National Diesel-Fuels & Lubricants Meeting in June SAE Journal

Synthetic Rubbers Demand Close Match of Properties With Service Requirements

PASSING of the so-called good old days when rubber was rubber and choice was limited chiefly to hard and soft varieties has introduced a new era offering a wide variety of synthetic rubbers, but imposing the responsibility of selection. It is becoming evident that synthetics will perform well, but that they must be carefully selected after full consideration of the exacting demands of the job itself and of the most suitable synthetic rubber compound.

Short course in the engineering business of matching service requirements with synthetic rubber properties will be presented in June *SAE Journal* by Gertrude H. Spremulli, of Ranger Aircraft Engines, Division Fairchild Engine & Airplane Corp. Her presentation will be concerned specifically with synthetic rubber applications on aircraft engines, but it will indicate basic needs – careful analysis of application and laboratory

testing of synthetic rubber stocks and finished parts.

Differences in chemical composition and in properties, and differing reactions to time, temperature, and other influences, seriously influence any selection, it will be explained. Emphasis will be placed on the question whether the synthetics are to substitute for, or to replace, natural rubber parts, it having been found that natural rubbers are superior in elasticity, low energy loss, low heat generation; synthetics in resisting the action of oils, solvents, and heat.

Navy Experiences With Mass-Produced Diesels Presage Peacetime Use

MASS production of light, compact, reliable diesel engines, direct result of dieselization of U. S. Navy ships for war service, appears to have post-war implications in the way of making available for peacetime power-production purposes engines which are highly adaptable.

The Navy seems to be impressed not only by the adaptability of diesels, but by their reliability and economy, according to Edward C. Magdeburger, head engineer, Navy Department Bureau of Ships. In June *SAE Journal* Mr. Magdeburger will present highlights of the Navy's experience with diesels ranging in size from 3-cyl jobs driving electric generator units to 32-cyl engines producing more than 2000 hp.

He will describe how the Navy is giving the diesel engine a thorough test and workout under maximum conditions, by necessity using every available type, whether two cycle or four, and whether vee, double-vee, porcupine, quad, pancake, or diamond in arrangement of cylinders.

The Navy is not only using the diesel, he will add, but is contributing to diesel progress. Experiments in using the ballistic effect of the exhaust to induce supercharging will be reported, and suggestions will be made that the next forward step in installation may be putting the diesel in an airtight compartment serving as a charging air receiver and supercharging automatically by engine-driven blower.

OVERCOME DIFFICULTY IN STARTING DIESELS WHEN MERCURY IS LOW

DIESEL engines have won an enviable reputation for economical power production when hard work is to be done, but also for being temperamental about starting when the mercury lurks in the lower reaches of the thermometer.

Since there are estimated to be somewhere around 1,250,000 diesels producing roughly 95,000,000 hp in the United States, and their power is needed in large part for war work, any such display of temperament during cold spells assumes the aspects of an epidemic engineering problem. It is estimated that about one-quarter of the diesels have climatic reasons to become temperamental for at least six months of the year.

Satisfactory progress in devising means of starting chilled diesels will be reported in June *SAE Journal* by G. H. Cloud and L. M. Ferenczi, of Standard Oil Development Co. They will say that normal petroleum hydrocarbon fuels will permit of starting at temperatures not below 20 F without supplementary aids. They will suggest that materials blended into normal diesel fuels in optimum concentration to improve cetane number and cold starting will give a reduction in minimum starting temperature of about 20 to 25 deg.

For the more stubborn diesels they will recommend that ethyl ether be introduced into the air stream to permit starting in temperatures down to −40 F, provided crankcase lubricants and cranking facilities allow sufficient cranking speeds.

Improved Synthetic Tires Winning Army's Confidence

Synthetic tires have been found by U. S. Army Ordnance to withstand practically everything except heat and overloading, and to be excellent for cross-country runs even in rock-strewn areas

FEW products will go into general consumption with such an extensive background of exhaustive tests as synthetic rubber tires. And few products ever have been awaited with such eager anticipation, nor have been the subject of so many and such conflicting rumors.

Basic fact is that the military forces, notably U. S. Army Ordnance Department, has been using synthetic tires for some time, and has been putting them to breakdown tests tougher than anything the average motorist can offer. Furthermore, Ordnance has been entirely realistic in its evaluation of the new tires, testing them under conditions of climate, weather, terrain, and service which would give definite answers to two pertinent questions: "Will they work?" and "Are they as good as natural rubber tires?"

The answers will be published in June *SAE Journal*, with supporting evidence compiled by Lt.-Col. B. J. Lemon and Capt. J. J. Robson, of Ordnance Department. Briefly, their answers will be that synthetics are working for the Army; that they are not yet as good as tires made from natural rubber.

These answers, however, do not tell the whole story. Additional basic facts, which every prospective tire user should know, will be presented somewhat along these lines:

- Synthetic tires are much better than no tires.
- Synthetic tires must be properly used.
- The Army has confidence in synthetic tires.

The authors will explain that the fortunes of war which shut off America's rubber supply left no choice. Tires of some kind had to be made. However unsatisfactory the first synthetic tires may have been, at least they were tires.

They will say that for most types of trucking synthetic tires will give adequate service, but cannot withstand long, sustained high-speed runs during summer months, particularly with overloads.

And they will express the opinion, based upon use of hundreds of thousands of tires, that synthetics are definitely not as good as the natural rubber products, but the quality difference between the two is steadily decreasing.

With all the qualifications currently necessary, the authors will present evidence that the synthetic tire future is reasonably bright and that the average consumer will find:

- In smaller tire sizes, synthetics are not only successful, but give service equivalent to natural rubber tires. They run upwards of 15,000 miles at high speeds on bad roads and cross country.
- Medium-sized synthetics, such as 7.00 to 10.00, are reasonably satisfactory, but cannot withstand high speeds, overloading, heat. Still they give 18,000 miles, or better, service.
- Large synthetics, on the order of 11.00 through 14.00, still are a problem.

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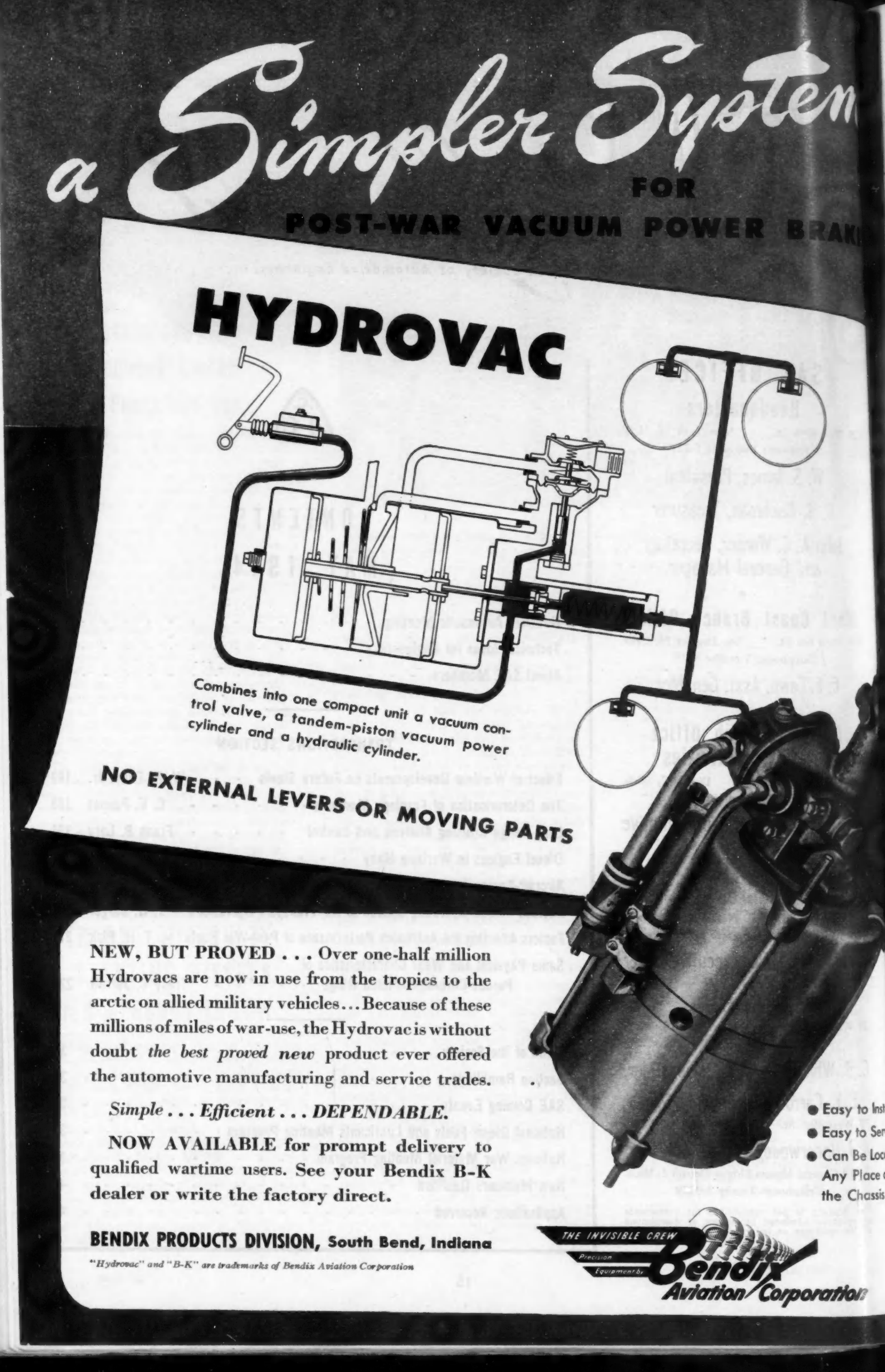
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U. S. Air Supremacy Achieved, Will Be Maintained, Through Coordinated Engineering Thinking –

General Warns SAE


At the SAE National Aeronautic Meeting, April 5-7, New York, A. L. Beall (left), general chairman of the committee, examined a captured German V.D.M. electric propeller with John D. Waugh, who later described the equipment. Mr. Waugh flew in from England to present his paper. The propeller was loaned to the meeting by the AAF Materiel Command, Dayton

THROUGHOUT the three-day 25-paper SAE National Aeronautic Meeting, April 5 to 7, in the Hotel New Yorker, New York, the inestimable value of well-planned engineering papers was repeatedly demonstrated as aircraft, engine, and accessory engineers freely discussed technical details which add up to better fighter and combat planes for the United Nations' fighting forces.

Maintenance of world air supremacy, a capacity dinner audience was told by Major-Gen. Frank O'D. Hunter, should be the nation's objective after wresting unconditional surrender from the enemy.

"Our air power is potent because our industry is potent. To you men who are the brains of the industry, the nation must give its solemn thanks," the commanding general of the U. S. Army's First Air Force said. Despite necessary restrictions of those details of aeronautical engineering that are still military secrets, the general explained many techniques of the air battles over Germany, closing with a dramatic combat film "Ramrod to Emden," showing the fighting equipment designed and built to a large extent by the men in his audience.

Preceding the general during the dinner session, SAE President W. S. James explained how the Society had been tooled up to coordinate engineering opinion and experience long before Pearl Harbor, and had enlarged its technical committee structure to serve the Army, Navy, other Government agencies, and industry in the public interest.

Discussing the new SAE Air Transport Engineering Activity under the chairmanship of William Littlewood, Mr. James said that now "There are, in the SAE aviation engineering portfolio, tremendous possibilities for the sane, sound, well-planned, and rapid engineering development of the whole helpful future of transportation in the air." "We have mutuality of engineering interest from the drawing board to the airport."

Toastmaster J. Carlton Ward, Jr., opened the dinner program following greetings by E. E. Husted, chairman of the Metropolitan Section. "America's invulnerability depends upon a trained Army and Navy which we must support, trained manpower – and not veterans of this war – which means compulsory military training, stockpiles of strategic materials and factories for arms manufacture, and continued engineering development of weapons, aircraft, ammunition, and automotive vehicles," Mr. Ward said. Neither Government nor industry, he said, can afford

HONORED GUESTS at the SAE National Aeronautic Meeting, April 6, were, left to right: Peter Altman, chairman, Wright Brothers Medal Board of Award; S. A. Guiberson, Jr., Guiberson Diesel Engine Co.; R. B. Beisel, manager, Chance Vought Aircraft; W. J. Blanchard, manager, Aeroproducts Division; W. P. Gwinn, general manager, Pratt & Whitney Aircraft; E. E. Husted, chairman, Metropolitan Section, SAE; L. E. Pierson, Jr., president, Aircooled Motors Corp.; D. P. Hess, president, American Bosch Corp.; M. B. Gordon, vice-president, Wright Aeronautical Corp.; R. D. Kelly, SAE vice-president; Dr. J. C. Hunsaker, chairman NACA; S. M. Fairchild, chairman, Fairchild Engine & Airplane Corp.; Lt.-Col. E. L. Johnson, national commander, CAP; Lt.-Col. W. S. Johnston, AAF; A. T. Colwell, SAE past-president; H. M. Horner, president, United Aircraft Corp.; Major-Gen. Frank O'D. Hunter, commanding general, AAF First Air Force, principal speaker, and J. Carlton Ward, Jr., toastmaster

to let down in any phase of engineering development following the cessation of hostilities.

William Littlewood, chairman of the new SAE Air Transport Activity Committee, amplified President James' recounting of the SAE expanded engineering advisory services by outlining the program of the new activity. Technical projects affecting all phases of air transport will be studied by his group, and reports will serve as a guide to airline operators in "increasing operating efficiencies, dependability, and passenger convenience." Air Transportation, he said, has now come of age, but "there is still a lot to learn. I want to pass along this advice to our junior engineers," he said.

To A. L. Beall, general chairman of the committee which planned the meeting, R. D. Kelly, vice-president for aircraft engineering, A. T. Gregory, vice-president for aircraft-engine engineering, and his other committee members goes the credit for developing a program of further coordinating the thinking and designing of tomorrow's fighting airplanes. Executive and project engineers of aircraft manufacturers, engine builders, accessory factories, airlines, military, and several Government agencies joined in looking into the future through the eyes of the accelerated experiences gained in the current design and production program of the nation.

The integration of engineering thinking through SAE meetings and technical committees lauded by Gen. Hunter and explained by President James continued through the three days and marked a new milestone in vigorous, incisive, technical exposition and discussion. The 700-odd engineers who attended the meeting were a clear cross-section of the aeronautic engineering fields which have combined to give Gen. Hunter and his military colleagues the fighters and bombers which have been effective, as he said, in aiding Russia's present ground advance.

During the dinner program C. E. Pappas, chief of aerodynamics, Republic Aviation Corp., was awarded the Wright Brothers Medal for the "outstanding contribution to aerodynamics in 1943" for his paper "The Determination of Fuselage Moments" delivered before the SAE Annual Meeting at Detroit, January, 1943. Peter Altman, chairman of the Award Board, made the presentation.

Several sessions of the three aeronautic activity meetings committees were held to plan advance meetings to bring to the whole membership reports of current engineering achievements and to again look into the future toward better aircraft for combat and for peace, with eyes focused upon the maintenance of world air supremacy for the United States.

Basic Research Key to Better Aircraft

CLOSER integration of the engineering thinking of aircraft designers and engineers developing engines, propellers, and accessories was demonstrated during the three aircraft, two aircraft and engine, and the aircraft production sessions which heard 11 papers by 13 authors.

President W. S. James, center, with SAE Vice-President for Aircraft Engineering, R. D. Kelly, and Major-Gen. Frank O'D. Hunter, the principal speaker at the National Aeronautic Meeting dinner, April 6, in New York.

Stemming from fundamental research by the National Advisory Committee for Aeronautics, other Government agencies, and industry, clearer requirements were laid down as essential for aircraft improvement than ever before. To amplify this type of work, a rich background of experience was reported by several engineers.

Manpower and energy will be saved when engineers follow the example of several speakers and discussers who have used punch card machines to speed computation. Thus, Everett Kimball, U. S. Bureau of Census, has developed a technique to obtain the coupled modes of vibration of aircraft struc-

Left to right: SAE President W. S. James; Vice-Admiral R. R. Waesche, Commandant, U. S. Coast Guard; Mac Short, SAE past-president; Thomas A. Morgan, president, Sperry Corp.; Arthur Nutt, chairman, SAE Aeronautics Division; Com. E. C. Beck, USN, Army-Navy Aeronautical Board; William Littlewood, Chairman, SAE Air Transport Engineering Activity Committee; F. C. Crawford, president, Thompson Products, Inc. (absent when photograph was taken); Alfred Marchev, president, Republic Aviation Corp.; C. E. Pappas, Wright Brothers medalist; F. H. Russell, president, Manufacturers' Aircraft Association; L. C. Goad, general manager, Eastern Aircraft Division; William R. Enyart, president, National Aeronautic Association; S. A. Stewart, general manager, Hamilton Standard Propellers; Benjamin Parry, N. Y. Weather Bureau; H. E. Conrad, manager, Central Aircraft War Production Council, Inc., and R. Dixon Speas, chairman, reception committee. A capacity audience of more than 800 engineers and executives heard Gen. Hunter and other speakers

tures through the iteration process of solving matrix equations, one of the speakers disclosed. He said machines have been so thoroughly adapted to the task that they not only expedite the computing of coupled modes of vibration which exist at zero air speed, but at any air speed, and even serve in solving flutter stability equations.

Research progress already has been made in studying and predicting the coupled modes and frequencies of aircraft structures through the use of mechanical and electronic vibration-measuring equipment. Complexity of this job was illustrated by listing merely the electronic instruments employed. They include: wire strain gages, crystal type acceleration pickups, carrier type acceleration pickups, velocity pickups, crankshaft torsional pickups, direct inking oscillographs, photographic recording oscillographs, oscilloscopes, linear amplifiers, carrier amplifiers, vibration meters, sound meters, vibration and sound amplifiers, mechanical pickups, mechanical frequency indicators and stroboscopes.

Development of time-saving and simplified formulas reducing to a few minutes' work a job of calculating radial and tangential stresses in disc wheels which once occupied 45 hr was also reported.

The formulas were said to be of especial help to aircraft design engineers and to represent an improvement upon the original Stodola formulas which permitted only approximations. These new formulas permit construction of a simple graph using rectangular coordinates in preference to alignment charts. At any point of a rotating disc there are a radial stress and a tangential stress, both produced by the centrifugal forces of the disc and of the blades. Total tangential stress at any point is found by adding the tangential stress due to the centrifugal force of the disc to the tangential force at the same point due to the centrifugal force of the blades. Radial stress produced by the centrifugal force of the disc was said to progress from zero at the periphery and at the bore, and to reach a maximum in the middle portion of the disc, the audience was told. Discussion disclosed the adaptability of this technique to a wide range of engineering calculations.

Installation of charge-aircooling systems in airplanes may produce some advantages, but also disadvantages in the way of crowding, increased frontal area, and lower effective horsepower. Some of the difficulties, as seen by the airframe designer, were revealed when a speaker characterized as naive the popular idea of placing an intercooler in any convenient vacant space in fuselage or nacelle, explaining that the "density" of some designs is remarkable, and adding that in a P-38 "one could scarcely hang his hat inside the P-38 boom between the spinner and the Prestone radiator." Typical frontal area for an aircooled installation with two stages of supercharging and intercooling in a high altitude fighter is 24 sq ft, of which 17 sq ft already are occupied by engine.

Three fundamental maximums of safety, weight, and serviceability were offered by another speaker. They were:

Saving of 250 lb in weight is worth more than the initial cost of an airplane;

Airplane assembly and installation operations now occupy 80% of a plane's construction time; and

Airplanes must be built and serviced by simple tools and simple minds.

These influence every design decision in aircraft engineering and because small causes lead to large air catastrophes, since every device and part known to man will fail sooner or later, it is imperative that the designer make such failures non-catastrophic. The speaker praised the American aircraft industry for developing multi-engine planes which are safe after the failure of one engine.

Popular concepts of airplanes loaded with ice, crashing to disaster are fallacious, a session was informed. Disastrous icing is more subtle than ice formation on wings or fuselage which may be the result of ice forming in intake scoop, carburetor, adapter, and turning vanes at the eye of the engine impeller, it was explained. Second most dangerous situation, it was said, was ice formation on propellers.

The airplane de-icing problem is far from being solved, and changes with aircraft design. Mechanical, chemical, and thermal means have been tried in an effort to combat formation of glaze and rime ice, with modern trends away from mechanical and chemical expedients and toward thermal. Engine exhaust gas is the source of heat. It was suggested that commercial flight cancellations are caused less frequently by ice-forming weather than by limitations of radio communication and blind landing facilities under such conditions.

Before aircraft operations can be safely planned without regard to the icing condi-

Costas Ernest Pappas receiving the 1943 Wright Brothers Medal from Peter Altman, chairman of the Board of Awards, April 6, during the SAE National Aeronautic Meeting. The annual award goes to the author "of the best paper on aerodynamics or structural theory or research, or airplane design or construction, which shall have been presented at a meeting of the Society or any of its Sections during the calendar year"

Session Chairmen, SAE National Aeronautic Meeting

Aircraft

W. B. BERGEN, Glenn L. Martin Co.

Aircraft Engine

S. K. HOFFMAN, Lycoming Division

Aircraft

R. D. KELLY, United Air Lines Transport Corp.

Aircraft Engine

R. N. Du BOIS, Packard Motor Car Co.

Aircraft Engine and Aircraft

R. W. YOUNG, Wright Aeronautical Corp.

Aircraft

W. LITTLEWOOD, American Airlines, Inc.

tions en route, communications and blind-landing facilities must be fully developed.

Despite the urgency of the present aircraft production program, basic research in aerodynamics is going on apace. A comprehensive report made by the National Advisory Committee for Aeronautics, for example, laid down fundamental guides to future cooling duct design. Detailed examples of how several effective changes were made were given, the author pointing to reliance on these guides in improving overall performance, particularly at high altitudes.

The report included conclusions on pressure changes for internal flow, relationship of internal drag to pressure depletion, influence of density decrease on internal drag, and showed the relative losses and availability of pressure in both original and revised charge-cooling installations which he described.

Power boost controls for planes so large the pilot's strength is inadequate, yet which give a human pilot constant "feel" of his ship, and also can be operated by conventional automatic pilots, were also described. They are desirable on planes of 150,000 lb gross weight, and over, and no substitute has been found satisfactory for stability requirements. Power boost normally is necessary on large ships, during take-offs and landings, but might be dispensed with in calm weather, experience showed.

Explaining the application of hydraulic power boost controls to the huge Martin "Mars," the speaker said the pilot constantly is assured of "feel" of the control surfaces, which begin to function with a movement of only five-thousandths of an inch of the controls. Use of power boost controls, he added, gives the pilot of a large plane flight control forces corresponding to those of a small plane.

Control of the design of sheet metal parts has become essential in the aircraft industry, demands research, because production needs are outgrowing experience, another speaker pointed out. Differences in details of parts to be formed frequently offset and upset human experience with sheet metal working, and it is becoming impossible to disseminate necessary information with either sufficient speed or thoroughness to keep pace with the growing personnel of an expanding industry.

How much elongation or compression metal can withstand under various conditions, and how to design parts within these established limits, are problems yet to be solved, the audience was told.

Formulas were presented for determining such limits developed by analysis of some parts-forming problems, and it was recommended that research be undertaken with every type of forming.

Manufacture of 1000 planes daily, once heralded as possible by adapting automobile mass-production methods to aircraft construction, has not been achieved. Reasons:

Product requirements of the aircraft-buying public, comprising the United Nations governments, are too strict;

Design changes to meet tactical needs are too frequent;

Capacity for absorbing planes, limited by necessity for training personnel to use them, is too limited; and

Demand, while larger than ever before, does not approach the volume requisite to mass production.

Application of mass-production techniques to aircraft manufacture has developed neither along the lines nor to the extent once widely predicted, largely because of differences in materials, manufacturing facilities, products, demand, time, and costs. Automobile and aircraft industries advantageously have exchanged techniques, the older industry contributing organization and management controls, engineering accuracy, and cost consciousness. The aircraft industry was said to have stimulated interest in new materials and methods, and to have reestablished "custom" techniques, which may be reflected in post-war trucks and buses.

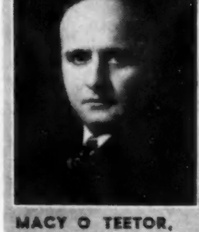
Design Changes Forecast for Aero Engines

FANS to cool aircooled engines appeared inevitable in aircraft powerplant development, as the majority of engineers agreed that improvements by baffles, water injection, or other avenues of approach to the problem appeared inadequate. Throughout the three aircraft engine and two combined engine and aircraft sessions, engineers heard reports of current development and test work to seek out hidden answers and to achieve the best compromises for improving engines for tomorrow's aircraft.

A prediction that high-altitude charge-cooled engines would be of two types was made as a result of current research. One would be a high specific output powerplant

All papers presented at this SAE National Aeronautic Meeting will appear in a later issue of the SAE Journal either in full in the Transactions Section or as digests

Aircraft Engine



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Aircraft Engine and Aircraft

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Aircraft Accessories

ERLE MARTIN, Hamilton Standard Propellers Div.

Aircraft Engine Production

N. N. TILLEY, Studebaker Corp.

Aircraft Accessories

CHARLES FROESCH, Eastern Air Lines, Inc.

Aircraft Production

PETER ALTMAN Engineering Consultant

with low-compression ratio for high performance, short-range aircraft. The other type would be one with moderate specific output, with a high-compression ratio, for long-range planes.

It was shown that supercharged engines actually will produce more power accompanied by fuel economy if intake charges are cooled to a point which eliminates detonation.

Engineers at these sessions were taken back of the scenes in major engine plants and shown the results of work on improved heat transfer, reduction of restrictions to external airflow, metallurgical and structural progress, piston-ring research, and other phases of the complicated problem of producing increased thrust horsepower.

How an automobile manufacturer has been able to put the Rolls-Royce engine into production was one of the highlights of the meeting. Unique was a "U" line installed to disassemble and assemble these engines after their test runs, and was one of a number of ingenious production ideas developed to increase production. However, the long experience of the industry in manufacturing to close tolerances and close running fits stood the industry in good stead when the company and its subcontractors undertook the task of building the British Merlin.

As the aircraft engine reaches higher and higher specific power output, piston rings continue to bedevil design engineers. The search for ring combinations to perform all operating functions equally well continues, engineers were assured. Reduced oil consumption and blowby, better control of sticking and wear, and preventing flutter at diving speeds were phases of research reported in the quest of better engine performance.

Infinitesimal motion, under compressive loads, will cause chafing of airplane engine parts, another report of a long and careful study showed. Elimination of the load and motion factors that cause parts chafing is preferable to application of coatings, such a lead plate, to the parts, the audience was told. Coatings may effect fatigue strength, they were warned.

Although the military services credit American engine designers with developing powerplants superior to those of the enemy, a spokesman for the Navy urged improved automatic engine control which would permit the pilot to concentrate at times upon shooting down the enemy. Fresh from combat experience, Lt.-Com. F. E. Johnson urged more standardization of controls, parts, and accessories, and made a plea for greater simplification. Engine controls, he said, should be combined in the throttle, and all equipment should be designed with a view to easier maintenance.

Corrosion is still an unsolved problem, despite the care now being taken in the preservation of engines and parts for shipment overseas. Despite every effort to provide enough parts to keep combat planes in flying condition, cannibalism of parts is still resorted to. "It is far better to have one airplane in combat condition than to have two grounded awaiting parts," he remarked.

How the pendulum of thinking has swung from extremely smooth cylinder surfaces to shotblasting and even sandblasting was disclosed at one session following the report on piston-ring research. At other sessions further experiences of shot blasting highly-stressed parts were cited as important contributions of the development of the airplane engine.

Getting up ahead of the engine, a capacity audience of engine and airplane engineers heard a careful analysis of propeller fitting following a statement of the variables of the problem. The best combination of propeller and gear-ratio requirements appeared to one speaker as depending primarily upon take-off wing loading, take-off power loading, and the range for which the craft was designed. Thus it is necessary for the engine to have a number of alternate propeller drive gear ratios evenly spaced over a range of values to achieve a close approximation to the best combination.

To the consternation of those who have spent long hours in attempts to further reduce weights, the idea of an infinitely variable transmission between the engine and propeller was injected, although several discussers felt that this may be the ultimate answer to the problem.

The versatility of the American aircooled aircraft engine was explained in detail by showing how tanks and other military vehicles have been powered by these engines, with appropriate modifications. The installations took considerable doing, but it was explained that the military authorities cooperated in every respect and the results were above even optimistic expectations. Contrary to lay opinion, light weight of the powerplant is desired even in tanks weighing 30 tons. Service experience showed that the equipment was relatively easy to maintain, and combat reports proved the effectiveness of the aircooled engines manufactured by three companies in the aircraft engine field.

Among the brilliant examples of close coordination of aircraft, engine, and accessory manufacturers and their engineers is the current project leading to man's ultimate conquering of distance. The short cuts over Mother Earth's vast areas are over the Arctic ice caps, and the goal of the cooperative efforts is to fly at great heights in temperatures as low as 60 F below zero, and operat-

"Hydraulic Engine Power Controls"

H. ALEXANDERSON,
Eclipse Pioneer Division

"Cold-Weather Operation of Aircraft"

G. A. BLEYLE,
Wright Aeronautical Corp.

"Engine Cooling Fan Theory and Practice"

KEN CAMPBELL,
Wright Aeronautical Corp.

"Measurement and Prediction of Aircraft Vibration"

E. F. CRITCHLOW,
CAA

"The Intercooling Problem in Airplane Design"

H. B. DICKINSON,
Lockheed Aircraft Corp.

"Relation of Intake Charge Cooling to Engine Performance"

E.A.DROEGEMUELLER,
Pratt & Whitney Aircraft Division

"The Pneumatic De-icer"

J. E. GULICK,
B. F. Goodrich Co.

"An Investigation of Chafing on Aircraft Engine Parts"

H. C. GRAY,
Wright Aeronautical Corp.

Co-author "Piston Ring Development for the V-770 Engine"

MAX EPPS,
Ranger Aircraft Engines Division

ing independently of ground equipment.

Key problems, one of the sessions was told, include cold starting of engines, more information on fuels and lubricants behavior at extreme low temperatures, the development of Arctic type batteries, and improvements in pilot and passenger comfort. With these problems solved, the calendar will be cheated as 4000 miles will be lopped off the present New York-Chungking trip, and Manila will be closer to New York by 2700 miles via Alaska. Current operations in cold subzero areas by the Army and Navy, as well as contract operations by airlines, are providing a wealth of experience which is counted upon to speed the achievement of dependable cold-weather flying, it was pointed out in discussion.

All papers presented at this SAE National Aeronautic Meeting will appear in a later issue of the SAE Journal either in full in the Transactions Section or as digests

Accessories *Developments On New Frontiers*

OPTIMUM aircraft performance can be attained only by thorough coordination of design of the airframe, engine, propeller, and accessories, engineers know. Throughout the three days, the meeting of minds of the country's outstanding aeronautical engineers demonstrated a singleness of purpose which augurs well for continued air supremacy.

For example, scores of engine engineers showed intense interest in developments of de-icing, and were gratified to hear that many hazards of ice formation on planes flying the North Atlantic have been removed by use of pneumatic de-icers, and of slinger rings and antifreeze fluid feed shoes, which supply alcohol to melt ice from the propeller.

They were told that pneumatic de-icers made from both natural and synthetic rubbers are applicable to the wings of all

Toastmaster J. Carlton Ward, Jr., left, with R. Dixon Speas, chairman of the Reception Committee, Vice-Admiral R. R. Waesche, commandant, U. S. Coast Guard, and E. E. Husted, chairman of the Metropolitan Section, who greeted the members and guests to the SAE National Aeronautic Meeting at the dinner

Co-author "Relation of Intake Charge Cooling to Engine Performance"

D. S. HERSEY, Pratt & Whitney Aircraft Division

Co-author "An Investigation of Chafing on Aircraft Engine Parts"

R. W. JENNY, Wright Aeronautical Corp.

"Fundamentals of Airplane Design"

A. L. KLEIN, Douglas Aircraft Co., Inc.

"Stresses in Disc Wheels"

WILLIAM KNIGHT, Curtiss-Wright Corp.

Co-author "Relation of Intake Charge Cooling to Engine Performance"

W. A. KUHRT, United Aircraft Corp.

"The Design for Production of Sheet Metal Aircraft Parts"

F. M. MALLETT, Curtiss Airplane Division

"Basic Principles of Power Boost Flight Controls"

E. G. RILEY, Glen L. Martin Co.

"Recent Trends in Airplane Ice Prevention Technique"

LEWIS A. RODERT, NACA

"Aerodynamics of Cooling Ducts"

K. F. RUBERT, NACA

Col. C. H. Caldwell, General Staff Corps, recently returned from combat zones, left, with Lt.-Col. E. L. Johnson, Civil Air Patrol; Com. E. C. Beck, member of the Working Committee, Army-Navy Aeronautical Board; and Lt.-Col. William S. Johnston, Army Air Forces, photographed prior to the dinner of the SAE National Aeronautic Meeting

planes and shortly will be able to de-ice satisfactorily in temperatures lower than −50 F. The de-icer will combat glaze ice, rime ice, and "glime" ice, which combines the worst features of the others, whether forming at rates of 1 to 5 in. per hr or 1 to 4 in. per min.

Completely new in de-icing techniques, the session was told, is an electronically-controlled system for inflating de-icer boots which enables the pilot to control inflation by location, length dwell, and frequency.

Aeronautical engineers took a careful look at the Nazi V.D.M. electric propeller used on the Luftwaffe's Heinkel, Focke-Wulf, and Messerschmitt fighters – and pronounced it good but gadgety.

The propeller was brought from London by plane, and exhibited by J. D. Waugh who flew to the meeting to present his paper. It was said to be superior to American design from a maintenance standpoint, and its ease of manufacture contributed to large-quantity production. Despite its excellent design, construction, and versatility it is not, in general, superior to American and British types, according to the speaker. He listed among its shortcomings an inferior electric governor and lack of provision for adequate lubrication. He added that since Frankfurt, Hamburg, and Duren have been severely bombed, it is reasonable to suppose production at V.D.M. factories has been disorganized or halted.

Continuing efforts to measure the "propulsive efficiency" of airplane propellers were described as difficult, expensive, not too accurate – but useful. The study reported was initiated in 1938 and concluded in 1943, and showed that flight tests of light airplanes are more difficult, but less expensive than wind-tunnel operations. Locations of a set of design and efficiency curves had been accomplished with satisfactory accuracy.

In flight tests, the report said, there is no single-valued function representing the relation between propulsive thrust coefficient and advance ratio for a given blade angle, this function depending on whether the airplane is climbing, diving, or in level flight.

From day to day improvements in engine design, fuels, lubricants, and aircraft design make necessary wider control ranges, higher manifold pressures, and engine speeds, another session learned. Changes in operating procedure and the constant tussle between those in favor of giving the pilot *all,* and

turn to p. 40

"Propeller and Gear-Ratio Requirements for Aircraft Designed for Cruising Operation"

R. S. SCHAIKER, Douglas Aircraft Co., Inc.

"Pre-Rotation of Landing Gear Wheels"

H. F. SCHIPPEL, B. F. Goodrich Co.

"Aircraft Engines in Tanks"

G. W. THOMAS, Continental Motors Corp.

"Piston Ring Development for the V-770 Engine"

C. H. VAN HARTESVELDT, Ranger Aircraft Engines Division

"Aircraft Engine Production As Viewed by an Automobile Manufacturer"

J. G. VINCENT, Packard Motor Car Co.

"Aircraft Maintenance Problems in the Combat Areas."

LT.-COM. R. E. WHITE, Navy Bureau of Aeronautics

T. N. KELLY, (picture unavailable) Consolidated Vultee Aircraft Corp.

"Analysis of Airframe Production Methods in the Aircraft and Automobile Industries"

Co-author "Propeller Efficiency of a Light Airplane"

W. R. WOODWARD, Bell Aircraft Corp.

"Propeller Efficiency of a Light Airplane"

K. D. WOOD, Purdue University

Technical IDEAS for ENGINEERS

★ ★ Briefed from Papers ★ ★
given at SAE SECTION MEETINGS

"ALL ABOARD! HELICOPTER AIR BUS LEAVES PROMPTLY FOR-!"

by AGNEW E. LARSEN
Rota Wings, Inc.
■ **Wichita, March 1**

(Excerpts from paper entitled "The Helicopter in Air Bus Transportation")

BUS lines all over the country recognize the essential similarity of their present service and that which the special flight characteristics of the helicopter render possible to augment or supplement their traffic. Their business is precisely that kind of transportation—of persons and light luggage on moderately short hauls.

Medium Size Recommended

Based upon previous successful operations, an intermediate size of helicopter was proposed at a recent hearing before the Pennsylvania Public Utilities Commission in behalf of a bus line serving Western Pennsylvania, New York and part of Ohio. The all-up weight of a five-place cabin autogiro, which was manufactured for the convenience of guests of the Miami Biltmore Hotel, and proved satisfactory, was 4500 lb and a 50 ft rotor was employed (free from any form of resonance). It was therefore urged that a 6600 lb helicopter using a 55 ft diameter rotor, a 550-600 hp motor, carrying a total of seven paid passengers and pilot, represented a practical size more readily attainable in the state of present knowledge with a minimum of further experimentation.

An approximate price of $40,000 per unit of equipment was taken. This equipment would be depreciated over a five-year period, or 20%, which is the current procedure of most airlines. These operations would require a fleet of eight airbuses with two in reserve, flying routes aggregating 2500 miles daily. Since the hops averaged between 25 to 40 miles and the longest overall run is approximately 200 miles, a limited tankage of 80 gal of gas is allowed, 10 gal of oil, 200 lb of baggage and 200 lb of mail and express.

The power loading based upon 550 hp will be 12 lb per hp. The disc loading, based upon a rotor of 55 ft diameter with an area of 2375 sq ft, will be about 2.7 lb per sq ft, which experience has indicated would be adequate for low speed safe landing.

A general analysis of operating costs was presented as follows:

Original cost $460,000
This includes 10 helicopters at $40,000 ea.; two-way radio equipment, ground facilities, $10,000; leasing and conversion of landing facilities, $50,000.

Monthly operating cost:

Specialized maintenance help and supervision (eight men at $400 per month)	$ 3200
Pilots (10 at $600 per month)	6000
Public liability and property damage insurance per month	200
Station dispatching, supervising and management wages (Based upon 15% of total mileage comparing helicopter air mileage to bus mileage.)	3000
Depreciation: helicopter and radio equipment	7666
Gasoline and oil requirements (figures based on gas consumption of all good aircraft engines ½ lb per bhp hr). 46 gal per 100 miles with 2500 miles daily operation, roughly 1200 gal, based upon 18c per gal, total monthly consumption	6480
Experience reveals oil consumption should be 1/10 gasoline consump-	

Eight-passenger helicopter airbus

Stylist Say... Designing Pace...

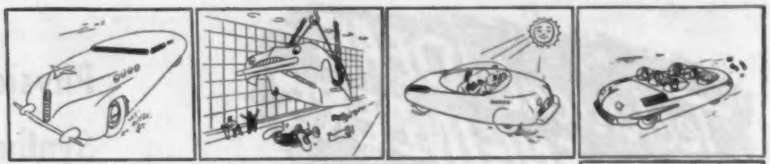
by RAYMOND LOEWY
Raymond Loewy Associates
■ **Chicago, March 15**

(Excerpts from paper entitled "Post-War Transportation – Automotive")

WE have heard and read a great deal recently about post-war designs in all fields of manufacturing. Some of the material emanates from responsible sources and some doesn't. The unfortunate fact is that the sensible stuff does not make popular, good reading. On the contrary, the same war-weary public that welcomes escapist literature and escapist movies encourages escapist pseudo-scientific post-war literature. It is largely responsible for bringing forth a profusion of silly articles in newspapers and magazines. By far the most fantastic material is written in reference to the field of post-war transportation. Serious designers are just as disturbed as engineers over this state of affairs and a dozen of us, established

Imaginative Progress

"**. . . . Where it stops, nobody knows...**"
—Loewy



for many years, are getting organized into a group to try to curb this trend.

However, the complete elimination of imaginative designing might be a definite setback. It is only regrettable that some large advertisers use some of the wilder stuff as illustrations in their advertising campaigns in a most indiscriminate manner. They lend weight and authenticity to the designs.

In and out of SAE meetings, car engineers and automobile stylists recently have been criticizing each other's ideas about post-war passenger car design.

***SAE Journal*, in the last six months, has carried the views of many leading car engineers as expressed at SAE sessions.**

In this article, one of the most experienced and best-known industrial designers tells his side of the story – crisply, frankly, and interestingly.

Engineer-Designer Cooperation

We have to admit that the introduction of appearance as a factor in automobile sales during the last 18 years does not seem to have handicapped the growth of the industry. On the other hand, we are familiar with certain pre-war American cars that were designed along very sensible lines by engineering staffs, with a minimum of emphasis on style, and that were resounding "flops" with the buying public. These vehicles may have been the engineer's dream, but they quickly became the dealer's nightmare. Engineers might, if they wished help, designers in many cases. For instance, most customers have only a nodding acquaintance with the mechanical features of the car. They may never see the differential or transmission, but they are in constant contact with ashtrays, dome lights and clocks. Why not give these a little attention.

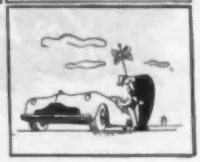
Foresees Simple Design

Flimsy ashtrays have probably lost to a manufacturer more customers than a poor clutch, or a bad transmission. As far as body design is concerned, we practical designers deplore, just as much as the engineers, the excessive weight and bulk of modern passenger automobiles. However, instead of looking back to the past, let's look to the future.

One factor that is common to all vehicles, and which is the crux of the whole problem, is weight reduction. The average automobile weighs 3500 lb – and 3500 lb of materials to transport one or two people does not make sense, as statistics show that 92% of the cars on the highways travel with empty rear seats. The weight trend in the past years has been decidedly retrogressive. For instance, the 1942 Ford is 350 lb heavier than the 1938 model. The 1942 Chevrolet is 900 lb heavier than the 1927 model. This must change. Heavy post-war taxation and reduction of our fuel potential alone will dictate this trend.

Whether or not the car is to be rear-engined is immaterial to us designers, and it is not for us to decide. However, if it cuts down weight, I am for it. As for appearance, some designers favor rear engine propulsion because it eliminates the hood and brings the passengers forward. On the contrary, hoods will remain as a protection to the forward passengers both for practical and psychological reasons. Hoods, however, will not be as bulky as they used to be and they will be designed for better visibility. The latter factor is of vital importance when one keeps in mind that in the United States alone each year 40,000 people are killed and 200,000 wounded and crippled in automobile accidents.

Powerplant accessibility will be improved. Engineers who are having a field day criticizing the designer might have a look at



their own backyard. In some late models, one has to take off a front wheel and a large sheet-metal panel in order to adjust a valve clearance.

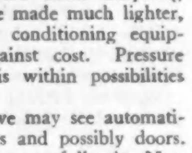
Regarding appearance, hysterical chrome-plated grilles are on the way out. They are costly, heavy and ugly. Low intake scoops will replace them. Field tests have proved that such scoops are practical. Heavy, clumsy bumpers should be replaced by lighter, better designed ones, saving many pounds and dollars.

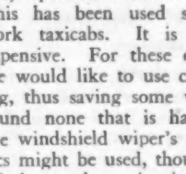
Price of the car will probably not go down. It may stay at about 35¢ per lb. But, cars will be cheaper to operate and maintain. I can't see aluminum or plastic bodies for some time, or plastic impregnated plywood bodies either, mostly because of the cost involved. However, plastics or light metal alloys can be used to advantage for trim and accessories. There is room for light alloys in the engine and chassis and for whatever parts that form unsprung weight. Seats could be made much lighter, but here, as with air conditioning equipment, we are up against cost. Pressure ventilation, however, is within possibilities in the low price field.

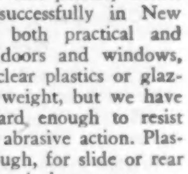
In the top bracket we may see automatically operated windows and possibly doors. This has been used successfully in New York taxicabs. It is both practical and expensive. For these doors and windows, we would like to use clear plastics or glazing, thus saving some weight, but we have found none that is hard enough to resist the windshield wiper's abrasive action. Plastics might be used, though, for slide or rear windows where abrasion is less severe.

As far as the vehicle's general appearance is concerned, we believe that correct basic forms will automatically produce better appearance. The right balance between width, length and height is of paramount importance. Clean, sharp highlights will take the place of applied chrome gadgets or expensive body mouldings. The new car will be fresh, clean and young looking. It will be powerful and it will be safe.

Most of our designs have been developed in close harmony with our clients' engineering departments. They may seem tame compared to some of the dream stuff you have heard or read about, but they offer the advantage of being within the range of practicability and within the range of reasonable cost.







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tion by volume. Oil 120 gal daily, 3600 gal per month, at 60¢ making a total cost of oil	2,160
Total cost of monthly operation	$28,706

This results in a proposed cost of operation of about 38¢ per mile.

With an anticipated 80% load factor throughout the entire operation, due to the highly specialized service and the potential demand for such service in this area, the fare of 7¢ per mile is proposed. This will result in earnings of 42¢ per mile, and an additional revenue of 1¢ per mile in anticipated air express, making a total of 43¢ per mile. On return tickets the round trip fare proposed will be 170% of the one way fare.

We recommended carrying out the first year's operation on the intermediate size equipment before adopting 15,000 or 16,000 lb helicopters of much larger dimensions, thus allowing actual operating experience to dictate the requirements during the interim as engineering research proceeds on the 14-place airbus.

Need for Practical Helicopter

In all of the interest which this recommendation has aroused, which is of pure business and commercial concern as distinguished from personal sport and pleasure, we have a persistent pressure for new and added means as an adjunct to existing means of air and ground transport. From this we can reason that the need is surely there, and the practical helicopter will, therefore, quickly result and yield.

Technical IDEAS for ENGINEERS

Chemists Holding Keys To Future Progress In Quality of Motor Fuel

by D. P. BARNARD and R. F. MARSCHNER
Standard Oil Co. of Ind.

▪ Annual Meeting, Jan. 10

(Excerpts from paper entitled "An Informal Long-Range Forecast of Motor Gasoline Developments")

THE problem of motor fuel improvement is basically one in chemistry. As there are so many chemical components in the gasoline boiling point range (a possible total of 5930 hydrocarbons), research into the fundamental properties of gasoline hydrocarbons has become a cooperative effort of the petroleum industry.

Characteristics of Motor Gasoline Hydrocarbons

Gasoline range hydrocarbons fall into four principal chemical categories: paraffins, cycloparaffins (or naphthenes), olefins, and aromatics.

Paraffin hydrocarbons are those in which carbon atoms are "saturated" with the maximum possible number of hydrogen atoms. Those in which the carbon-to-carbon linkage is a continuous chain are known as "normal" paraffins, while those involving branching of the carbon chain are denoted as "iso" paraffins. An important characteristic of all paraffins and one which results directly from the fact that they are completely saturated with the greatest possible number of hydrogen atoms, is that they have the highest calorific value of any of the hydrocarbons (about 19,000 BTU per lb net). Light paraffins contain relatively more hydrogen than the less volatile ones. The total number of paraffins in the motor gasoline range is 650.

In order to achieve much higher goals as far as paraffins are concerned, methods must be found for converting a considerable number of the more undesirable isomers into more highly branched and therefore more desirable forms. Also, improved volatility becomes significant.

Next in abundance are naphthenes, which are characterized by a ring configuration, and as a result, contain two less hydrogens than paraffins of the same number of carbon atoms. They are of relatively more importance in the intermediate and heavy thirds of motor gasoline than in the light third. There is a definite possibility of securing a limited amount of 100-octane gasoline from naphthenic hydrocarbons, but the possibility of doing so in the near future is less than in the case of the paraffins.

Olefin hydrocarbons, like naphthenes, contain less hydrogen than the paraffins, and as a result the calorific value and lead susceptibility are lower, the calorific values being about 2% below the paraffins. The average octane number of the olefins thus far tested would be 82 ASTM with 1 cc of lead in the light third of the gasoline, 81 with 1 cc of lead in the intermediate third, and the heavy third would be about the same. It seems clear it will never be possible to produce motor gasoline of 100 ASTM octane number in quantity from olefins alone.

Aromatic hydrocarbons, like the naphthenes, are relatively more important in the intermediate and heavy fractions than in the light fraction. A mixture of all 80 possible motor fuel aromatics would not quite be 100 ASTM octane, with 1 cc of lead. About a third of them should exceed 100 octane, and only a few are below 90. The importance of aromatics in increasing octane numbers of olefinic gasolines is obvious.

Motor gasolines of the future, like those of the past, will be mixtures of all four classes. It is believed that motor fuel of 1960 may exceed 88 ASTM octane number, but will probably not reach 92 ASTM octane number.

The Volatility Problem

The gasoline volatility problem reduces in the main to separate tasks of keeping vapor pressures down (and, therefore, front end boiling points up), and 90% and end points down, at the same time avoiding undue loss in yields from crude. Improving volatility – like improving knock rating – depends on the development of economically justifiable processes for converting less desirable hydrocarbons into those falling within the desired volatility range.

Physical Evaluation Permits Selecting Synthetic Rubbers for Automotive Use

by CLINTON M. DOEDE
Connecticut Hard Rubber Co.

▪ Southern Ohio, March 14

(Excerpts from paper entitled "Synthetic Rubber")

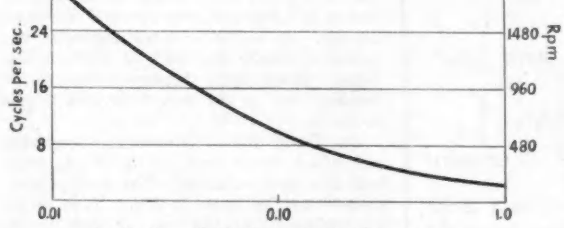
THREE-FOURTHS of the rubber consumed in this country is used in automotive tires. Technical committees with rubber companies advised that Buna S (obtained by the catalytic dehydrogenation of ethyl benzene) is the synthetic to be made for this purpose. Of the remaining quarter of the rubber consumed, approximately one-half goes into items which can be well made from a good tire synthetic rubber, and the other one-half goes into products which are used and designed for application when natural rubber, or its specific substitutes, cannot be used.

It is frequently possible, unfortunately, to compound a given rubber for one or two particular properties at the detriment of the others. This procedure is questionable when another type of rubber has those desired properties within its normal range and would actually give more satisfactory results. Specific properties of rubbers made for particular purposes are usually evaluated for that problem.

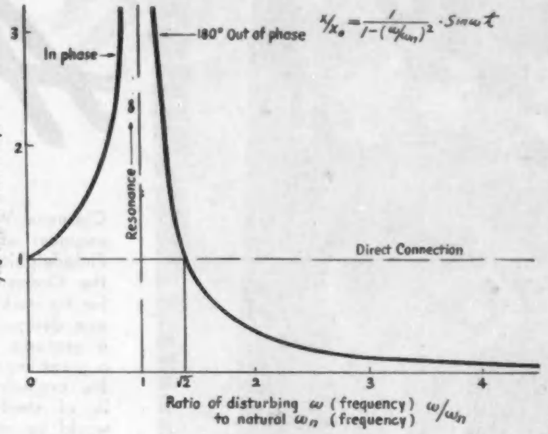
Whenever corona, ozone and sustained dielectric strength are needed, the evaluation should approximate field service. To date, it has not been possible to effectively separate these phenomena.

Whenever a rubber is to be used in periodic or continuous contact, with a fuel or lubricant, it is essential to know the dimensional limitations allowed after the piece has been put into service and whether the physical properties or dimensional changes after contact with the liquid are the more important.

The simple physical dimensions of a piece may often be a determining factor. A sharp radius will often cause flex failure or electrical breakdown. An unnecessarily thick section may allow heat deterioration or low



▪ Fig. 1 – Relationship, in an undampened gravitational system with sinusoidal vibration, between magnitude of deflection and frequency of vibration



■ Fig. 2 – Transmissibility of vibration changes as ratio of the disturbing frequency to the natural frequency of an undampened system varies

temperature inflexibility. A heavy section and a thick one in a given piece will not allow the optimum properties in both sections; one will be overcured and the other undercured.

Rubber is now and will, in future, be more extensively used as a material to dampen vibrations. Two idealized relationships with one degree of freedom, fundamental to all vibration dampening evaluations are given in Figs. 1 and 2. Fig. 1 shows the relationship, in an undampened gravitational system with sinusoidal vibration, between the magnitude of deflection and the frequency of vibration. Fig. 2 shows how the transmissibility of a vibration changes as the ratio of the disturbing frequency to the natural frequency of an undampened system varies. Where this ratio is unity, the transmissibility is infinite and the system is said to be at resonance. The value w/w_n should always be as large as possible, other factors accounted for.

The fact that rubbers can be made to adhere strongly to metals, have excellent sound absorbing qualities, do not require lubrication, are resilient, have inherent dampening properties, may be fabricated easily to complicated shapes, have good dynamic fatigue resistance and can be obtained with low permanent set, makes them desirable material for this type of application.

The design for application of a rubber mount should also have included in it:

(a) the fact that rubber in shear is about five times as effective as rubber in compression. Only slightly more effective is rubber in tension, and should be used only rarely, as surface cracks, cuts and tears progress through the material used this way at a much more accelerated rate with resultant early mechanical failure.

(b) mechanical supports and stops to serve as safety measures. Many machines pass through resonance as they come up to, or slow down from operational speed, and this resonance amplitude should be snuffed out.

(c) uniform load distribution to insure maximum effectiveness of the dampener as a system.

(d) an understanding of the temperature range involved. Most rubbers will function as dampeners from about −40 deg to −200 deg. Below this they act as mechanical supports and above it the heat deterioration rapidly shortens the effective life.

(e) an understanding of the probable amount of heat generation in the mount itself as a result of the dampening activity. Usually a large safety factor may be allowed. Where weight and space limitations are severe, however, an experimental evaluation of these factors is necessary.

Wartime Progress Puts Diesel in Competition With Gasoline Engines

by DR. P. H. SCHWEITZER
Pennsylvania State College

■ Philadelphia, March 8

(Excerpts from paper entitled "More HP Per LB of Diesel")

THE most significant recent advances in diesel engineering pertain to the 2-stroke-cycle engine. In a diesel, where pure air is charged into the cylinder, scavenging can be done with air without wasting fuel. This makes the 2-stroke cycle practicable for the diesel.

The most efficient type of scavenging for 2-stroke-cycle engines is the uniflow or straight-through scavenging. One can trap roughly 20% more air in that manner than by cross or loop scavenging. There are just three ways known to produce uniflow scavenging in a cylinder: by poppet valves in the head, by opposed-piston design, and by sleeve or slide valves.

Advantage of the 2-stroke-cycle sleeve-valve engine lies in the absence of poppet valves, which permits the use of simple symmetrical cylinder heads. Highpower output is the result. Its disadvantage is the difficulty of cooling and lubrication because of the sleeve. Sleeve-valve diesels are now being developed for marine and aircraft propulsion. A 20-cyl sleeve-valve aircraft engine in an advanced stage of development is to give 2000 hp on one shaft and to weigh 1.8 lb per hp.

If air charge is forced into the cylinder with super-atmospheric pressure, the amount of charge can exceed displacement volume. This is called supercharging and is becoming popular with 4-stroke-cycle diesel engines. The main objective of supercharging in the diesel engine is to increase power output at sea level.

At present, engine cooling puts a practical limit to the supercharging of the diesel engine. The more power the engine delivers, the more heat has to be taken care of to prevent overheating. Sticking of piston rings, burning of pistons, cylinder heads, and exhaust valves give trouble frequently in highly supercharged engines. Complete solution of these problems is a time-taking process, but progress is being made. Porous-chromium-plated cylinders and piston rings, oil-cooled pistons, sodium-cooled valves, directed high-speed water cooling, and compounded lubricating oils are a few recent developments in this direction.

Discussion

Replying to the question, what has the war done to the diesel engine and the diesel engine to the war, Dr. Schweitzer stated that the war has brought into use many improved production methods which enable the diesel to compete more successfully with the gasoline engine and foreshadow its increased commercial use when peace is restored.

Dr. Schweitzer pointed out that the advantage possessed by the diesel is in its low fuel consumption fully as much as in the

turn to p. 45

Economic Requirements of Motor Gasoline Manufacturing Processes

Fundamental economic requirements of processes for improving the quality of motor fuel are:

1. A process for converting low octane number normal paraffins into high octane number branched paraffins, or high boiling point material into more volatile components, must be one that will use "poor" gasoline as a raw material and convert it into a "good" gasoline without destroying more than a very small fraction.

2. Processes must be evolved which will convert low-grade hydrocarbons (those not in the gasoline range) to gasoline hydrocarbons of the desired octane number and volatility.

3. Processes must not cause the loss of a significant amount of hydrogen, for this means wasting crude from an energy standpoint. Since hydrogen has a calorific value of about 52,000 BTU per lb as compared with 12,000 for carbon, conservation and economy cannot be overemphasized.

4. Any process, in addition to being efficient from a crude standpoint, must also be operable and its cost must be supported by the value of the improvements effected.

Another factor which should be given careful consideration when predicting octane number improvements is the well-known characteristic of the octane number scale, in which as the numbers become larger, each unit becomes more significant. For example, for the interval 69 to 70 octane number, one unit improvement may be considered as permitting an increase of 0.5% in thermal efficiency of the appropriate engine. It is characteristic of the octane number scale that the importance of an individual unit increases as we proceed up the scale, and it is characteristic of the basic chemistry of fuel manufacture that each octane number becomes progressively more difficult to produce. Improvements in octane numbers must bear an increasing amount of scrutiny from the standpoint of cost versus usefulness.

About S

Clarence W. Moore (center), chief engineer of United Specialties Co., Philadelphia, is shown being awarded the Ordnance Department Citation for his work in the development of a new design of pressed steel plug on a grenade projector, which effected a great improvement in the quality of the projector. An estimated 90,000 lb of steel and 7000 machine hr would be saved in making a million projectors. Pictured with Mr. Moore, who has originated many of the mechanical improvements included in the design recently adopted for special rifle grenades by the Army, are Lt.-Col. A. D. Kelso and Jared Ingersoll, to his left, and Majors V. W. Smith and H. Gadsden, to his right

M. DWIGHT PEARCE, JR., formerly employed in the Fisher Body Division of General Motors Corp., Naval Ordnance Section, Purchasing Department, Detroit, is now with Smith, Hinchman & Grylls, Inc., same city, as a production engineer.

M. B. CRAWFORD, previously field manager for Pesco Products Co., Cleveland, is now associated with United Air Lines Transport Corp., Chicago.

COL. FRANK J. HIERHOLZER, formerly deputy director of the Maintenance Division, Army Service Forces, Washington, is now chief of the spare parts branch of the same division.

E. G. EMERY, JR. is now project engineer of Higgins Aircraft Inc., New Orleans. He had been field representative of Pesco Products Co., Cleveland.

FREDERICK E. MOSKOVICS has been appointed industrial consultant of A. O. Smith Corp., Milwaukee, Wis. For the past three years Mr. Moskovics was technical adviser to the supervisor of the AAF, and had been in Government service since this country's entry into the war in 1941.

Frederick E. Moskovics

MARTIN ROBERT RASPET, who had been automotive mechanic's instructor, National Defense Training Program, Pittsburgh Public Schools, is now a warrant officer, USMC, Amphibian Tractor Detachment, stationed at Dunedin, Fla.

ALVA W. PHELPS, formerly assistant vice-president of General Motors Corp., has been elected president of Oliver Farm Equipment Co. Mr. Phelps had been in charge of engineering and manufacturing divisions employing in excess of 80,000 people, among which were the Frigidaire, Delco Products, and Eastern Aircraft Divisions.

Alva W. Phelps

L. S. BARKSDALE is no longer chief project engineer for Adel Precision Products Corp., Burbank, Calif. He has opened his own engineering office in Glendale, where he will do consulting and development work on mechanical and hydraulic equipment for aircraft.

THOMAS W. CONRON, JR., is now an ensign in the U. S. Navy. Before entering the service he had been chief die designer, Chevrolet Muncie Division, General Motors Corp., Muncie, Ind.

SAE members who comprise part of the Detroit Board of Commerce's New Products and Materials Committee, conceived to bridge the gap between the man with an idea and the producing organization capable of developing and marketing it, include: Chairman **WILLIAM H. LEININGER,** president, Leininger Industrial Co.; **JOHN H. HUNT,** director, General Motors Corp.; **W. B. HURLEY,** staff engineer of Detroit Edison Co.; **A. L. LOTT,** president and general manager, Motor Products Corp.; **C. J. REESE,** president, Continental Motors Corp.; and **WILLIAM B. STOUT,** director, Stout Research Division of Consolidated Vultee Aircraft Corp.

JOHN D. NEWTON, II, has been transferred from 361st Engineers Regiment at Camp Claiborne, La., to A. P. O. 578, c/o Postmaster, New York City.

TRUMAN F. SCHRAG, former field engineer for Timken Roller Bearing Co., Detroit, with which organization he had been associated since 1926, is now assistant chief engineer for Graham-Paige Motors Corp., same city. Mr. Schrag is an active member of the Detroit Section Reception Committee.

Truman F. Schrag

SAE Members

Realignment of the engineering department of Pratt & Whitney Aircraft Division, East Hartford, Conn., has involved position changes for the following SAE members: **ALEXANDER H. KING** from chief design engineer to chief designer, acting as consultant to all design groups; **NATHANIEL HAYNES,** formerly designer, and **LEWIS M. PORTER,** formerly mechanical engineer, to design project engineers of the New Engine Group; and **CARL N. FURAY,** formerly design supervisor, **CHARLES A. MORSS,** formerly designer, and **CHESTER R. WELLS,** formerly designer, to design project engineers in the Production Engine Group.

Alexander H. King

PETER ALTMAN, a member of the newly-formed SAE Air Transport Engineering Activity Committee (*SAE Journal,* March, p. 37), was erroneously listed as director, manufacturing research, Vultee Aircraft, Inc. The *SAE Journal* announced his new connection as an engineering consultant, Detroit, early last year.

GEORGE C. SCOTT, JR., a lieutenant (jg), A-V(S), USNR, who was formerly assistant inspector for naval aircraft at Edo Aircraft Corp., College Point, N. Y., is now assistant Bureau of Aeronautics' representative for the same company.

PAUL G. HOFFMAN, president of Studebaker Corp. and chairman of the board of the Committee for Economic Development, appeared recently in the March of Time movie "Post-War Jobs," in which he explained that private business must do bold, realistic planning now to make its maximum contribution to high post-war levels of production and employment.

ROBERT JOHN SWIFKA, formerly mechanical draftsman for Dow Chemical Co., Saran Development, Midland, Mich., is now connected with the Austin Co., same city.

Heads Sales

Julian J. Frey (right), formerly director of the technical service department, Ethyl Corp., has been appointed general sales manager of the company. He joined the company in 1927, and last year became head of the merged five service divisions of the company as well as chairman of the corporation's War Committee

DAVID L. KIDD, previously a student at Ohio State University, is now in the U. S. Army, stationed at Oak Ridge, Tenn.

JOSEPH H. ROGOTNICK, formerly associate liaison officer for the Office of Lend-Lease Administration, Washington, is now chief of the Iceland Section, Foreign Economic Administration, same city.

LESTER L. SHERMAN has recently been named superintendent of transportation of Consumers Public Power District, Lincoln, Neb. He had been traffic and safety engineer for Iowa-Nebraska Light & Power Co., same city.

SAE members who have recently been appointed to the newly organized Supply and Transportation Committee of the Petroleum Administration for War are: **J. L. NOLAN,** manager, oil department, Farmers Union Central Exchange, Inc., St. Paul, Minn.; and **L. A. SNYDER,** vice-president in charge of sales for Champlin Refining Co., Enid, Okla.

DONALD M. McDOWELL, formerly assistant project engineer, Wright Aeronautical Corp., engineering department, Plant 1, Paterson, N. J., is now with American Airlines, Inc., La Guardia Field, N. Y., as senior engineer.

WILLIAM LOUIS KAHN, previously a student at Purdue University, is now at Pre-Midshipmen's School, Asbury Park, N. J.

THOMAS M. WILKES is now a lieutenant colonel in the Ordnance Department, and may be reached at A. P. O. 518, c/o Postmaster, New York City.

JACK L. ALFORD has been promoted to a lieutenant (jg), USNR, and is stationed at the Naval Air Station, San Diego, Calif.

CAPT. WALTER L. MacARTHUR, U. S. Army Ordnance Department, has been transferred from A. P. O. 722 Group E, Seattle, Wash., to Maintenance Division, Army Service Forces, Pentagon Building, Washington.

D. EARLE WILLIS, formerly a consulting engineer with offices in Chicago and Detroit doing industrial engineering and special machine designing, is now research

Brig.-Gen. W. P. Boatwright (left), commanding general of the Detroit Ordnance Office, pins the Legion of Merit Medal on Col. J. M. Colby, extreme left, chief of the development branch of the Ordnance Department. The award was given for Col. Colby's work in North Africa in organizing supply and maintenance of Ordnance material in that area.

engineer for Tampa Shipbuilding Co., Inc., Tampa, Fla.

SAE members who have been named to the advisory committee representing the automotive parts industry include: **FREEMAN G. ALLEN**, general service manager, White Motor Co., Cleveland; and **N. A. MOORE**, vice-president and general manager of Sealed Power Corp., Muskegon, Mich.

MYRIN LUNDIN, formerly test engineer for General Electric Co., Schenectady, N. Y., is now junior engineer for Kellex Corp., New York City.

GEORGE W. HAZEN, who has been promoted to a captain in the U. S. Army Ordnance Department, may be reached at the Ordnance School, Aberdeen Proving Ground, Md., where he is technical liaison officer.

EDDIE DE WOOD COREY is now a motor machinist's mate first class in the U. S. Coast Guard, and may be reached at the Patrol Base, Wilmington, Calif.

R. THORNTON SAVAGE, previously a student at Chrysler Institute, is now technical service engineer for Catalytic Development Corp., Marcus Hook, Pa.

ROBERT H. JEFFERS, previously time study man for Cadillac Motor Car Division, General Motors Corp., Detroit, is now in the U. S. Army, stationed at Victorville, Calif.

H. W. FILBRY, Consolidated Vultee Aircraft Corp., San Diego, Calif., has been made an engineering representative for the corporation to the Ford Motor Co. For sometime past he was B-24 materials engineer at San Diego.

R. L. WEIDER, White Motor Co., Cleveland, has been named executive engineer of the bus department. He had been experimental engineer for the same company.

GILBERT K. BROWER is now chief materials engineer for American Airlines, Inc., La Guardia Field, New York City. Formerly Mr. Brower had been materials engineer at the same place.

Henry H. Kerr

HENRY H. KERR has joined Hayes Industries, Inc., Jackson, Mich., where he is engaged in sales and engineering of aircraft products. Mr. Kerr spent 14 of his 20 years as an engineering specialist in the aviation field in development and service activities covering aircraft landing gear and hydraulic systems.

C. S. Davis

C. S. Davis, president of Borg-Warner Corp., above, as he presided at a recent post-war planning conference attended in Chicago by 85 officials and key men of Borg-Warner divisions and subsidiaries

HEINRICH SCHNEIDER is now a partner in the consulting engineering firm of Schneider Bros. Co., Hamilton, Ohio. He was formerly president for Hydro Transmission Co., same city.

WILLIAM F. CHASE, who is in the U. S. Army, has been transferred from State College, Pa., to Special Engineers Detachment, Barracks B, Oak Ridge, Tenn.

WILLIAM H. FISHER, a lieutenant colonel in the U. S. Army, may now be reached at Headquarters 176th Battalion, 97th Regiment, Camp Hood, Tex. Colonel Fisher was formerly attached to the A.G.F. Replacement & School Command, 228th Infantry Training Battalion, Camp Blanding, Fla.

HENRY D. STECHER has been named president and general manager of the Romec Pump Co., Elyria, Ohio. He recently resigned as chief engineer of the Weatherhead Co., Cleveland, where he served for about 15 years.

F. M. HARDENDORF has moved from the U. S. Naval Air Technical Training Center at Jacksonville, Fla., where he was supervisor of phase instruction, to the one at Memphis, Tenn.

J. MITCHELL WATSON has been named chief of the Steel Division, Metals & Minerals Branch of the War Production Board, Washington. He was formerly metallurgical engineer for the U. S. Army Ordnance Department, Tank-Automotive Center, Detroit.

LT.-COL. A. CARYL BIGELOW, formerly chief of the liaison section, Stock Control Division, U. S. Army Headquarters, Army Service Forces, Washington, may now be reached at A. P. O. 7552, c/o Postmaster, New York City.

NORMAN C. RAABE, who had been chief of the trailer section, Automotive Division, War Production Board, Washington, is now regional representative, Division of Transport Personnel, Office of Defense Transportation, Atlanta, Ga.

JOHN L. PARKS has recently become associated with Briggs Clarifier Co., Washington. He was formerly plant superintendent for Brown Equipment & Mfg. Co., Charlotte, N. C.

CAPT. EDWARD RICKENBACKER, president and general manager of Eastern Air Lines, Inc., received an honorary degree of Doctor of Science at Westminster College's 90th annual commencement May 20.

JOHN E. WALSTON, civilian automotive adviser for the U. S. Army, is with the Fifth Service Command, Second Army, Camp Campbell, Ky. He was formerly with the 10th Armored Division, stationed at Fort Benning, Ga.

J. H. E. WEBB, a pilot officer in the RCAF, may now be reached at the Bombing & Gunnery School, Paulson, Man., Canada. He was formerly at the School of Aeronautical Engineering in Montreal, Que.

DANNY YUKE SING, previously connected with Stinson Aircraft Division, Wayne, Mich., is now with Stout Research Division, Dearborn, Mich.

GORDON J. CUSHMAN, a warrant officer in the U. S. Army, is stationed at Headquarters, I Troop Carrier Command, Stout Field, Indianapolis. He was formerly a master sergeant at the Office of Administrative Inspection, Baer Field, Fort Wayne, Ind.

COL. CLYDE M. HALLAM has been transferred from Fort Sill, Okla., Field Artillery School, where he was director of the Department of Motor Transport, to A. P. O. 103, Brownwood, Tex., where he is assistant chief of staff, G-4.

Previously an engineer for Ford Motor Co., Dearborn, Mich., **J. S. VOIGT** is now assistant chief engineer at Nash Kelvinator Corp., Kenosha, Wis.

HUGH C. AUMENT, JR., a lieutenant (jg), USNR, may be reached at Fleet Post Office, V.F. (N) 77, San Francisco, Calif. He had been acting engineer, Air Forces Training Detachment, Roosevelt Field, Inc., School Division, Mineola, L. I., N. Y.

Lt.-Col. John K. Hampton

JOHN K. HAMPTON has recently been promoted to the rank of lieutenant colonel in the USAAF. Col. Hampton is Air Corps area representative at the Nashville Area Office, Nashville, Tenn.

HAROLD E. WEBB, formerly vice-president for Adel Precision Products Corp., Burbank, Calif., is now executive assistant of research and development at Kinner Motors, Inc., Glendale, Calif.

HAROLD W. KLOOS, formerly a student at Ohio State University, is now in the U. S. Army, stationed at Oak Ridge, Tenn., in Barracks Area, Barracks C, Special Engineer Detachment.

LT.-COL. OTTO LESSING, USMC, has moved from Camp Pendleton, Oceanside, Calif., to an overseas base, and may be reached c/o Fleet Post Office, San Francisco.

GORDON G. ALLAN, who is with the U. S. Army Ordnance Department, has been transferred from Detroit, where he was engineer of fuels and lubricants equipment, to the Technical Division of the Fuels & Lubricants Section in Washington.

R. BRUCE WISEMAN, formerly design engineer in the Fuel Research Division of Waukesha Motor Co., Waukesha, Wis., is now senior engineer for the Buda Co., Harvey, Ill.

WILLIAM E. HERBY is now connected with Continental Aviation & Engineering Corp., Detroit, as contact engineer. He was previously assistant chief engineer of Vimalert Co., Ltd., Jersey City, N. J.

HOWARD C. DAVIS, formerly a student engineer at Detroit Diesel Engine Division of General Motors Corp., is now with Battelle Memorial Institute, Columbus, Ohio, as mechanical engineer on research projects.

PAUL R. CHURAN has recently joined Johns Hopkins University, Silver Springs, Md., as senior engineer in the Applied Physics Laboratory. He was formerly process engineer for De Soto Division, Chrysler Corp., Detroit.

Formerly chief engineer for United Specialties Co., Chicago, D. L. BENNETT is now chief engineer for Kropp Forge Co., same city.

JOHN W. HORNER, who had been research test engineer for Guiberson Diesel Engine Co., Dallas, Tex., is now development engineer for Aerojet Engineering Corp., Pasadena, Calif.

ARTHUR G. HOLMS, previously test engineer for Ranger Aircraft Engines, Division of Fairchild Engine & Airplane Corp., Farmingdale, L. I., N. Y., is now test engineer in the stress department of Wright Aeronautical Corp., Paterson, N. J.

JOHN F. HOHL, a lieutenant in the U. S. Army, may be reached at the Miami Air Depot, Miami, Fla.

MAJOR FRANKLIN R. NAIL, U. S. Army Ordnance Department, is now chief of the Wheeled Vehicle Unit, Engineering Section, Office of Chief of Ordnance, Detroit. He was formerly chief of the Truck & Trailer Unit of the same office.

JOSEPH GESCHELIN, Detroit editor of Chilton Publications, who has been serving with the Bureau of Ships, U. S. Navy, as an automotive consultant on call since Pearl Harbor, is now attached to the Bureau of Ships Engine Coordinating Office recently established in Detroit. Mr. Geschelin was 1943 SAE vice president representing the Production Activity.

Joseph W. Frazer, right, who has been president and general manager of Willys-Overland Motors, Inc. since 1939, is now president of Warren City Mfg. Co., Warren, Ohio, makers of engineered welded steel products

Succeeding Dr. N. E. Woldman, ARTHUR W. F. GREEN, Pratt & Whitney Aircraft Engine Co. of Missouri, has been appointed chairman of the SAE Aircraft Accessory Materials & Processes Coordinating Subdivision. Dr. Woldman resigned because of the pressure of work at the Bendix Eclipse Division. He is succeeded by A. B. Lovett of that company on the committee.

Arthur W. F. Green

CAPT. HORACE L. ARNOLD, U. S. Army Signal Corps, has been transferred from the Detroit Field Station to Fort Monmouth, N. J., where he will be Newark Signal Corps inspection zone liaison officer.

RICHARD E. CREDE, formerly chief tool engineer for Fostoria Screw Co., Fostoria, Ohio, is now senior methods engineer for Sperry Gyroscope Co., Inc., Great Neck, L. I., N. Y.

ARTHUR J. ROEMER, who had been layout draftsman for Allison Division, Indianapolis, is now a mechanical engineer for Marathon Paper Mills Co., Menasha, Wis.

V. O. GRIFFIN has obtained a military leave of absence from General Motors of Canada, Ltd., Oshawa, Ont., Canada, where he was junior layout man in the engineering department, and is now a sub-lieutenant (E) in the Royal Canadian Naval Volunteer Reserve. He may be reached c/o Fleet Mail Office, Halifax, Nova Scotia.

EDMUND R. MELLENGER, who was formerly with Ward & Palzer, New York City, is now connected with the British Ministry of War Transport, same city.

H. T. DANIELS, previously associate principal inspector of machinery for the U. S. Navy, has recently joined Climax Engineering Co., Clinton, Iowa, as field service engineer.

JOHN M. HENDERSON, JR., a lieutenant colonel in the U. S. Army Ordnance Department, 229th Ordnance Base Group, has been transferred from the Ordnance Unit Training Center, Texarkana, Tex., to the Pomona Ordnance Base in California.

Formerly a mechanical engineer for ISC Flame Cutter Corp., New York City, JACK W. BARRETT is now in the U. S. Army, stationed at Aberdeen Proving Ground, Md., at the Ordnance School.

EDWARD A. SIPP, previously manager of research and development, Multi-Vent Division, Pyle-National Co., Chicago, is now general sales manager for Guardian Electric Mfg. Co., same city.

ENSIGN ROBERT BOTHFELD, USNR, is now assigned to Special Task Air Group One, c/o Fleet Post Office, San Francisco. He was formerly assistant engineering officer of squadron, Naval Air Station, Monterey, Calif.

MAJOR ROBERT W. JENKINS has been transferred from Camp Wolters, Tex., where he was in Headquarters, 14th Regiment, to A. P. O. 15159, c/o Postmaster, N. Y.

E. OLNEY JONES, director of Federal-Mogul Corp., Detroit, since 1929, and vice-president, has been recently appointed a secretary of the corporation.

EVERETT W. GOSS, a corporal in the U. S. Army and former student of Ohio State University, may now be reached at Company F, Fort Monmouth, N. J.

G. LLOYD SMITH has been named manager of Smith-Summers Motor Co., Fullerton, Calif. He was formerly sales and service manager of Roadmaster Products Co., Los Angeles.

ROBERT E. WILSON, president of American Oil Co., Pan American Refining Corp., New York City, said in an address on "Technology as a Multiplier of our Natural

Resources" March 9 at the dedication of Pan American's new Catalytic Cracking Unit in Texas City, that, "despite outstanding accomplishments of new oil-finding and producing techniques, if it were not for developments in refining technique, we would not have enough crude oil to meet present demands, and the quality would be such that modern airplanes or automobiles could not even operate."

GUY WESTON EMBREE, formerly a student at the University of California, is now a mechanical engineer for the National Advisory Committee for Aeronautics, Moffett Field, Calif.

JOHN R. PARKS, formerly plant superintendent for General Forging Co., Chicago, has become associated with the D. L. Auld Co., Columbus, Ohio.

F. M. MERRIAM is now employed by GMC Truck & Coach Division in New York City as field service engineer. He had been shop superintendent for the War Department, Ordnance Service Command Shops, Camp Crowder, Mo.

CLARENCE E. MOORE has been named maintenance manager for Great Lakes Greyhound Bus Co., Detroit. Mr. Moore was formerly tank maintenance engineer for the U. S. Army Ordnance Department, same city.

Previously chief of the Miscellaneous Production Section, Tank-Automotive Center, Detroit, **THEODORE A. KREUSER** is now staff assistant to the general manager of Bendix Products Division, Bendix Aviation Corp., South Bend, Ind.

CAPT. PHILIP C. FAITH has been transferred from Camp Reynolds, Greenville, Pa., where he was in the Civil Affairs Officers' Pool, A.S.F. Replacement Depot, to A. P. O. 179, c/o Postmaster, New York City.

STANLEY G. MARKS has joined the engineering staff of Allis-Chalmers Mfg. Co., Springfield Works, Springfield, Ill. Mr. Marks was formerly assistant engineer for Wilcox-Rich Division of Eaton Mfg. Co., Detroit, where he had been employed for the past 10 years.

Reports from Stockholm announce that **COL. BERNT BALCHEN**, manager of Norwegian Airlines in New York and famed American Polar flier, has arrived in Sweden on an official mission. Although there was no authoritative comment on his assignment, it was understood that he may be establishing an American airline service to Sweden. Col. Balchen was named a U. S. Army air specialist in 1941.

ENSIGN HENRY SHABLUK may be reached at the Aircraft Engine Laboratory, Naval Experimental Station, Philadelphia Navy Yard. He was formerly an engineer for Continental Aviation & Engineering Corp., Detroit.

WARNER T. TABB, previously an engineer for Eisemann Magneto Corp., Brooklyn, N. Y., is now associated with International Plainfield Motor Co., Plainfield, N. J., in the same capacity.

COM. W. L. ANDERSON, USN, has been transferred from the Mare Island Navy Yard, Calif., and may be reached c/o Fleet Post Office, San Francisco.

FILO HARRIS TURNER, JR., has been promoted to a lieutenant in the U. S. Navy, and may be reached c/o Fleet Post Office, San Francisco.

LT. ASHTON K. STONE, USNR, who had been assistant to the inspector of naval material for petroleum products, U. S. Navy, Philadelphia, may now be reached at Navy 1955, Box 8, Naval Station, c/o Fleet Post Office, New York City.

EUGENE JOHN WELKER, formerly civilian chief of machine tools, Small Arms Branch, U. S. Army, Office of Chief of Ordnance, Industrial Division, Washington, is now vice-president of Welker Machinery Co., Inc., Detroit.

Formerly layout draftsman for Wright Aeronautical Corp., Paterson, N. J., **F. L. PARSONS** is now chief engineer for Capitol Engine Co., Edgewater, N. J. He is also associated with Bergen Engineering & Sales Co., consulting engineers in Hackensack, N. J.

LT.-COL. WALTER C. THEE, a member of the SAE T & M Activity Committee, may now be contacted at A. P. O. 962, c/o Postmaster, San Francisco.

FRANK E. WATTS, who is with the U. S. Army Ordnance Department, has been transferred from the Office of the Chief of Ordnance in Detroit to Washington, where he is liaison representative of conversion in the Industrial Division of the Office of Chief of Ordnance.

Assignments of SAE members with Lockheed Overseas Corp. in England include modification engineering work on operational aircraft by **LEONARD ANDREW COLSTON**, formerly a North American Aviation engineer; formerly group head in charge of technical training, **VERNON BENFER** is now service engineer for the company; **WILLIAM KESEMANN** is engineering instructor for the Royal Air Force on American engines as a part of the reciprocal arrangement between the RAF and AAF, and **JACK SHANNON** has been doing inspection work and carburetor calibration.

EDWARD C. WELLS, chief engineer of Boeing Aircraft Co. and leader in the design and development of four-motored airplanes, was recently honored as "Seattle's Young Man of the Year" at a dinner held at that city's chamber of commerce.

CAPT. WILLIAM B. GIBSON, who is in the U. S. Army Corps of Engineers, has moved from the Engineers Replacement Pool, Columbus General Depot, Columbus, Ohio, to the Presidio Shops and Yards, San Francisco.

HENRY BJELLAND, who had been with the U. S. Army Ordnance Department in Tacoma, Wash., has been named Government field service representative for Ford Motor Co., Dearborn, Mich.

LT.-COL. C. G. KUSTNER, who is in the Corps of Engineers, has been transferred from Fort Leonard Wood, Mo., to Camp Claiborne, La., where he is in the 1330th Engineers Construction Battalion.

CLARKE ALDEN RODMAN is now fuels and lubricants chemist for Mack Mfg. Corp., Plainfield, N. J. He had been research oil chemist for Triplex Oil Co., Long Island City, N. Y.

ROBERT J. ELBRECHT, a machinist in the U. S. Coast Guard, has been transferred from Fort Hancock, N. J., to the Brooklyn Navy Yard in New York.

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OBITUARIES

Noah B. Smith

Noah B. Smith, owner of Smith, Rudy & Co., analytical and consulting chemists in Philadelphia, died recently at the age of 82. He had been with that firm since its establishment in 1907, first as a partner, then as sole owner. Mr. Smith started his career as a chemist with Sloss Iron & Steel Co., and later was connected with Dayton Coal & Iron Co., South Chicago Furnace Co., and Embree Iron Co. in supervisory capacities. He received his B. S. degree from Brown University in 1885, and also attended M.I.T. for a year. A member of the SAE since 1930, he was also a member of the American Chemical Society and ASTM.

Andrew Fuller Johnson

Andrew Fuller Johnson, owner and operator of D. & D. Correspondence School for Automotive Body Makers since 1918, died recently. He was 90 years old. Mr. Johnson, who was a life member of the SAE, started in the carriage body-making business in 1878 with Zenas Thompson & Bros. and later was with Brewster & Co. He interrupted his career for a year when, in 1885, he studied designing and drawing under Albert Dupont in France, after having graduated from the Technical School for Carriage Draftsmen.

James G. Bruce

James G. Bruce, 55, editor of *Canadian Automotive Trade*, published by the MacLean Publishing Co., Ltd., of Toronto, Ont., died March 27 after a year's illness. A native of Scotland, Mr. Bruce joined the Russell Motor Car Co. when he came to Canada, remaining with that company up to and after it became affiliated with Willys-Overland Ltd. He served there as assistant factory manager, factory manager, and general parts and service manager. When Willys suspended their activities in Canada, he went to Hudson Motors of Canada Ltd. as general service manager, where he worked for a brief period before entering the editorial field in 1937.

Samuel O. White

Samuel O. White, director of engineering at Warner Gear Division, Borg-Warner Corp., died April 1 at the age of 61. A councilor of the SAE during 1932-1933, Mr. White had been an active member of the Indiana Section since joining the Society in 1917. Five years after graduating from Purdue University in 1904 Mr. White became chief engineer of Warner Gear Co., remaining with the same outfit up to the time of his death.

News..

..OF THE SOCIETY

Steel Industry, Auto Engineers To Develop Hardenability Bands

PLANS for accelerating the development of tentative hardenability bands, for ultimate use in specifications for popular grades of steel, were worked out at a conference between representative steel users and the Technical Committee on Alloy Steel of the Iron & Steel Institute held in the Institute's offices in New York on March 23 and 24, 1944. The meeting was held under the auspices of the Joint AISI-SAE Committee on Hardenability Data which has been working on this problem for nearly a year.

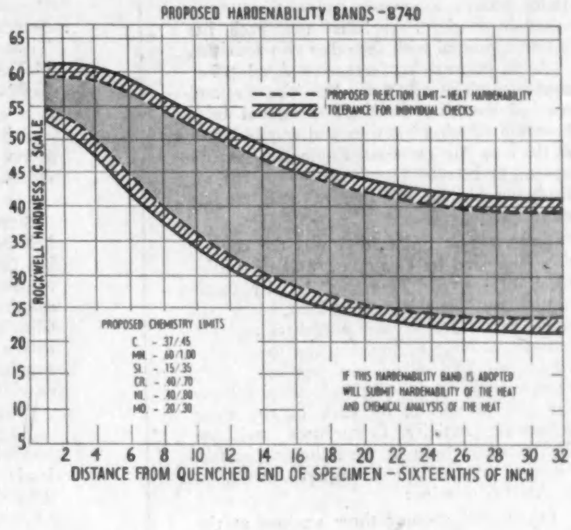
As a result of the conference, the AISI Alloy Steel Technical Committee is working at high pressure to develop by the late spring tentative bands for all popular grades of steel which, when formulated, will be distributed by the SAE for user reaction. Modified chemistry will apply to the steel purchased to these bands. It is planned to publish them subsequently as a joint AISI-SAE project. These bands will be subject to later review at some definite date such as six months after their original issue.

To illustrate the procedure which the AISI proposes to follow in developing the bands for user review through the SAE, a band for NE 8740 was used as an example. The procedure used in developing the tentative bands will be published by the AISI.

The AISI group recommended that, if the bands formulated are satisfactory, specific points only be used as limits for specification purposes and that otherwise 2 point Rockwell C plus or minus should apply. No band limits are to be shown below 20 Rockwell C. It was further recommended that producers report on shipping papers the hardenability of the heat in the same manner as composition, the hardenability data to consist of points or complete results as required. Steels purchased to the bands are to be identified by the suffix letter "H" following the identification number and when such reference appears modified chemical composition will apply.

Tests will be made on cast specimens which have been found to give representative results. Testing procedure will be in accordance with the SAE standard except for quenching and normalizing temperatures.

Proposed hardenability curves, in the form of bands, would give the proposed rejection limit and tolerances for individual checks. The purpose of the joint AISI-SAE project is to give designers assistance in choosing proper steels for a given part or structure



To reduce the differences in results obtained in different laboratories, the SAE was asked to review its test standard with a view to making it more precise and a subdivision of the SAE Iron & Steel Division is being organized for this purpose.

To fill the gap in hardenability between 8740 and 4340, it is planned to develop a modified chromium-nickel-molybdenum steel.

More Data Needed

Producers and consumers have been asked to file test data on all heats furnished to hardenability requirements for use in making revisions in the bands.

Representing the SAE at the conference were the Iron & Steel Committee of the War Engineering Board, user members of the Executive Committee of the Iron & Steel Division of the SAE Standards Committee, and representatives of the Materials and Processes Subdivision of the SAE Aeronautic Division.

The following were present at the Joint AISI-SAE Meeting: John Mitchell, Carnegie-Illinois Steel Corp.; Joseph Field, Bethlehem Steel Co.; Ralph R. Leo, American Steel & Wire Co.; Ben A. Kornhauser, Navy Bureau of Aeronautics; Herman H. Hannink, Wright Aeronautical Corp.; A. J. Pepin, Wyman-Gordon Co.; Lt. C. M. Mottley, Bureau of Ships; C. A. Loomis, Bureau of Ships; Lt. (jg) F. R. Steckel, Bureau of Ships; N. L. Deuble, M. W. Kellogg Co; E. T. Walton, Crucible Steel Co. of America; Henry Wysor and E. A. Reid, Bethlehem Steel Co.; B. Clements, Wright Aeronautical Corp.; E. Dudley, Curtiss-Wright Corp.; M. A. Tran, Park Drop Forge Co.

Also J. G. Morrow, Steel Co. of Canada; A. L. Kaye, Carnegie-Illinois Steel Corp.; G. W. Gable and M. J. R. Morris, Republic Steel Corp.; R. H. Norton, Alan Wood Steel Co.; W. G. Bischoff, Timken Steel and Tube Division; W. J. Buechling, Copperweld Steel Co.; L. E. Ekholm, Alan Wood Steel Co.; H. Bornstein, Deere & Co.; A. Boegehold, General Motors Research Laboratory; H. B. Knowlton, International Harvester Co., Inc.; F. P. Gilligan, Henry Souther Engineering Co.; R. B. Schenck, Buick Motor Division; F. C. Young, Ford Motor Co.; R. W. Roush, Timken Detroit Axle Co.; E. H. Stilwill, Chrysler Corp.; E. O. Mann, Chevrolet Motor Division; J. R. Pigott, Wisconsin Steel Co.; C. H. Herty, Jr., Bethlehem Steel Co.; L. L. Ferrall, Rotary Electric Steel Co.; A. F. Sprankle, Carnegie-Illinois Steel Co.; F. F. Vaughn, Caterpillar Tractor Co.; Joseph A. Zerkel, Youngstown Sheet & Tube Co.; W. P. Eddy, Jr., Pratt & Whitney Aircraft Division; L. C. Boyd, Carnegie-Illinois Steel Corp.; and Col. J. H. Frye, Army Ordnance Department.

Propeller Nomenclature

STANDARD nomenclature and definitions for dual rotation and co-axial propellers was agreed upon at a meeting of the Propeller Subdivision April 7. Procedures to be followed in coordinating propeller manufacturers' comments on Government specifications when requested to do so by the WCAB was also decided upon.

Plans were made for the work of individual committees for 1945.

SAE Aircraft Activities Plan for Year's Meetings

THE three separate SAE activity committees in the aeronautical field are working together to develop an integrated schedule of SAE aeronautic meetings for 1944-1945.

Implicit in the decisions of the Aircraft, Aircraft-Engine and the Air Transport Activity groups to coordinate on a common schedule is the firm belief that each has interests mutual with the other two activities.

At an informal conference on April 5, key men of each of the three Activities met and reached tentative, unofficial agreement as to how the meetings' desires and requirements of the new Air Transport Engineering Activity might best be coordinated with the already established schedule of SAE aircraft meetings.

Important at this session was the conviction expressed by Chairman William Littlewood of the Air Transport Activity Committee that, for this year at least, his group could best serve its own members and the industry at large by participating in already-established SAE aeronautic meetings. Such participation, later ratified officially, following full discussion, by each of the three aeronautic Activity Committees and the SAE Council, brought the following specific decisions by the Air Transport Activity at its April 6 meeting:

(1) It will sponsor three sessions at the October meeting in Los Angeles, which has been renamed an SAE National Aeronautic Meeting in recognition of its expanded scope; (2) it will sponsor all air transport engineering papers desired by the SAE Chicago Section at the National Air Cargo Meeting; (3) it will sponsor at least two sessions at the SAE 1945 Annual Meeting; (4) it will join with the other two Activity Committees in sponsoring the 1945 SAE Aeronautic Meeting in New York.

In addition, the new SAE Air Transport Activity went ahead and lined up specific papers and authors for the October meeting in Los Angeles and for the Air Cargo Meeting in Chicago. Definite plans for the 1945 Annual and the Spring 1945 Aeronautic Meetings will be made at a later meeting.

The Air Transport Activity Committee elected seven members as a nominating committee for a 1945 vice-president. Chairman Littlewood defined the scope of the new activity as follows: anything which affects safety, economy, reliability, and convenience of air transport or aircraft. The committee voted to approve this decision.

The Aircraft and Aircraft Engine Activity Committees, which met April 5 and 6 respectively, developed definite programs for the October meeting in Los Angeles and outlined papers for the 1945 Annual Meeting, as usual.

Rambling Throug Sec

GUEST speaker at **CANADIAN SECTION'S** March 22 meeting was SAE President W. S. James, shown here at a luncheon tendered him during his stay in Toronto. Seated in the center, l. to r., are: Roy E. Cole, vice-president of Studebaker Corp.; President James; Alex Gray, Section chairman; John A. C. Warner; and John L. Stewart, past SAE councilor and past-Section-chairman. Seated below are, l. to r.: Past-Chairman J. H. Hickey; Section Treasurer Martin Buckingham; Vice-Chairman presumptive George J. Beattie and Councilor and Section Past-Chairman Neil P. Petersen. Standing, l. to r.: Section Secretary Warren B. Hastings; Past Councilors and Past Section Chairman C. E. Tilston and W. E. McGraw; Roy H. Davis, president of Atlas Steels, Ltd.; C. E. McTavish, chairman of Section's meetings committee; Section Past-Chairmen Marcus L. Brown and James C. Armer . . .

SAE President W. S. James drew record audience at **CHICAGO SECTION'S** South Bend meeting Feb. 15, with 180 attending the technical session, and 137 coming for dinner . . . Roy E. Cole of Studebaker was technical chairman . . .

Sunshine is guaranteed by **CLEVELAND SECTION** for annual golf outing to be held May 26 at Chagrin Valley Country Club with Chairman Walt Howard assuming full responsibility for the weather . . . Non-technical presentation of problems confronting the diesel industry at declaration of national emergency in 1940 and solution to those problems given by Section's Vice-Chairman R. S. Huxtable of Cleveland Diesel Engine Division at April 10 meeting . . . Paper, which included details of various types of installations for Naval vessels and other war applications, supplemented by sound movie "Diesel – The Modern Power" . . . Film covered development of 4-cycle diesel and change to 2-cycle . . .

Essential replacement requirements for passenger cars this year were estimated last fall as "not less than 30 million tires," according to a report by F. B. Davis, Jr., U. S. Rubber Co., at **DETROIT SECTION'S** April 3 meeting . . . it seems that the industry cannot make more than 22 million, he said, with circumstances forcing 15 million of this total into the last six months of the year . . . only 7 million passenger car tires will be produced before mid-year, Mr. Davis asserted . . .

Joint meeting between Central Indiana Section of ASME and SAE **INDIANA SECTION** March 16 another session of glimpses into tomorrow . . . Post-war personal airplane will have basic conventional designs to which we have been accustomed, but with genuine improvements for safety and comfort, idea of speaker Edward R. Burn of Aeronca Airplane Corp. . . . Predicted they will be two- or three-passenger ships, in lower price brackets, with more power and higher speed . . . Does not foresee four-place plane in mass production for several years to come, due to its high cost . . .

Color film "Fortress in the Air," showing manufacture, design and performance of world-famous flying fortress concluded **MID-CONTINENT SECTION'S** March 17 meeting which featured Landon B. Boyd's talk on recent developments on accessories and parts for keeping oil and combustion chambers clean . . .

Tables turned March 8 when **MILWAUKEE SECTION** was invited to meeting of Army Ordnance Association to hear Major-Gen. Levin H. Campbell, Jr., chief of Ordnance, describe weight of guns, shells and ranges of 155 mm, 200 mm, and 240 mm guns in discussion of Heavy Ordnance in Battle . . . Radio talk delivered by a doctor in Germany quoted, in which he was reported as saying intensity of fire by Allies in Italy was terrific . . .

Triple bill at **NEW ENGLAND SECTION'S** April 3 meeting, with Carl T. Doman, SAE President W. S. James and John A. C. Warner viewing future of airplanes and fuels at largest program attempted by Section since Pearl Harbor . . .

Symposium on truck and tractor operation sponsored by **NORTHERN CALIFORNIA SECTION** March 30 consisted of round-table discussion devoted to problems of people in Stockton, Calif. (where meeting was held) in truck transportation field . . .

Section Reports

Speaking to more than 220 members of **PITTSBURGH SECTION** and Aero Club at joint luncheon meeting March 16, G. Edward Pendray, Westinghouse Electric & Mfg. Co., said that "new post-war industries will spring from wartime development of rockets, jet propulsion planes and gas turbines. There is nothing fantastic about rocket power any more – the rocket gun has been made a deadly weapon, and is no longer merely an entertaining addition to a fireworks display" . . . Eventually, he stated, rocket power may enable a man to build a 1500-mph plane, but before that it will perform many less thrilling but useful tasks, as assisting conventionally powered planes during the take-off . . . Mr. Pendray also told about the weather rocket, which may be shot into the air at hundreds of points to provide forecasters with instantaneous and highly accurate reports about huge masses of air that govern the climate on earth – giving weather forecasts two weeks ahead instead of two days . . . Toastmaster Cliff Ball, overwhelmed by talk, remarked at its conclusion, "Superman, here I come!"

Account of a new non-vapor-locking electric fuel pump given by A. L. Korte, Carter Carburetor Corp., at **ST. LOUIS SECTION** March 14 . . . "How the Carburetor Carbs" enlightening title of J. T. W. Moseley's talk at the same session, after which carburetors and war materiel manufactured by home company exhibited for inspection for all those present . . .

Post-war aviation fuels will be produced on a made-to-order basis to fit whatever specifications various operations demand, and will probably fall into four general categories: (1) for long range, (2) for 500-1000 mile operations, (3) for intercity or short haul schedules, and (4) for private fliers . . . this outlook presented to **TEXAS SECTION** March 14 by Fred L. Witt, Humble Oil Co., who said that refiners have not yet entered large-scale production of long range fuel . . . he described it as containing a greater number of Btu's per pound, having an antiknock value so high the octane register is inadequate for it, and as being economically superior to any present day fuel even though it costs more . . . With long range type, cruising altitude speeds will climb above any to which operators are now accustomed, and it will provide optimum performance on nonstop flights of about 1000-1250 miles . . . Fuel for the private flier will be 91 octane, which is superior to that burned by the putt-putts before the war . . .

Thirteen of **WASHINGTON SECTION'S** past-chairmen present at March 13 meeting, when they were awarded scrolls honoring their service to the Section . . . Request that assembly stand for 30 sec to offer silent prayer for peace wholeheartedly acknowledged by gathering of 265 . . . History and development of modern torpedoes discussed by E. M. Seifert, Naval Torpedo Station in Alexandria, Va., at April 10 meeting . . . Talked of the nonconfidential features of the modern, high-powered, long-range automobile torpedo used throughout the world today on all naval battlefronts . . . Relationship of various units of a torpedo to one another and to the complete "fish" also stressed . . .

Annual dinner meeting of **MUSKEGON GROUP** held March 30, at which are shown, at speakers' table, Section Chairman Paul S. Lane; President W. S. James; Lewis Kalb, who presented a copy of the Ordnance Distinguished Service Award to the Section; Earl Ginn, past-program-chairman; Stuart Nixon, past-chairman, and Paul Fuller, chief engineer of Fitz John Coach Co. . . .

Design and action of hydraulic torque converters explained by Roger G. Delong, Twin Disc Clutch Co., at March 27 meeting of **PEORIA GROUP** . . . slides, colored movies and a disassembled converter supplemented talk, which included discussion of application of hydraulic torque converter to such fields as diesel locomotives, hoists, cranes and oil field and logging equipment.

Planning for an active semester in SAE affairs, the **CCNY STUDENT BRANCH** at their Feb. 23 meeting formed social, athletic, program and publicity committees as well as student council and campus representatives . . .

OREGON STATE COLLEGE SB meeting March 17 joint SAE-ASME session, where W. G. Furry of Lockheed disclosed, among other engineering developments in the aircraft industry, that the Lightning will be 280 mph on one engine . . . illustrated talk with technicolor film "P-38 Flight Characteristics" . . .

Rubber Spec REVISIONS

INTENSIFIED work on synthetic and natural rubber classifications and physical requirements for acceptance inspection continued to progress in joint SAE-ASTM Technical Committee A on Automotive Rubber at its meeting April 12 in Detroit, under the chairmanship of W. J. McCortney, Chrysler Corp.

Among the projects going forward are:

Development of a revised standard to take the place of the present one for Rubber Compounds for Engine Mounts (pp. 501, 1943 SAE Handbook) which has been cancelled. The new standard will provide for using synthetics, and be compatible with the new revised Classification and Physical Requirements for Rubber Compounds that will be published in the 1944 SAE Handbook. Chairman of Section I, which undertook this assignment, is J. H. McWhorter, Ohio Rubber Co.

A revision of the Brake Hose standards (pp. 502-506, 1943 SAE Handbook) was the project assigned to Section III. The revision will include changes in the ASTM test method, and the project covers hydraulic, vacuum and air brake hose. The work will coordinate with the new classifications of natural and synthetic rubbers, according to M. J. DeFrance, Goodyear Tire & Rubber Co., general chairman of the section. A subgroup, headed by L. Cranston, U. S. Rubber Co., is developing new specifications for oil and fuel hose materials.

The cooperative program with the Army Ordnance Department on synthetic V-belts, including extensive field tests being conducted by the Army, nears completion, Chairman A. J. Kearfoot, General Motors Research, reported. The project of Section VI was initiated in the interest of conserving critical materials.

To fill a needed series of specifications on gasket materials, Section X has been formed under the chairmanship of J. P. Wilson, Ford Motor Co., on the classification and specification of materials for this purpose. The work will embrace all types of materials including fibers, asbestos rubber, rubberized materials, cork, and armored metallic. Inspection test requirements will be included in the final report of this section. Twenty members and alternates of Committee A represent users, 21 producers, and more than 10 are representatives of the Navy Bureau of Ordnance, Bureau of Ships, Bureau of Aeronautics, the Army Ordnance Department, and the Army Air Forces.

User members on Technical Committee A and alternates are: Chairman McCortney and J. C. Dudley, Chrysler Corp.; Vice-Chairman Harvey Doering, R. T. Vanderbilt Co., Inc.; H. E. Churchill and J. M. Gauss, Studebaker Corp.; Bishop Clements and D. T. Booth, Wright Aeronautical Corp.; J. G. Gagnon and G. L. Searles, Hudson Motor Car Co.; Miss Jane B. Hutson, Glenn L. Martin Co.; J. L. McCloud and J. Paul Wilson, Ford Motor Co.; W. H. Mohr and R. A. VanDeventer, Packard Motor Car Co.; W. M. Phillips and A. J. Kearfoot, General Motors Research; R. B. Stringfield, Consolidated Vultee Aircraft Corp.; and C. E. Zwahl and C. F. Orloff, Chevrolet Motor Division, General Motors Corp.

SAE Coming Events

National Meetings

DIESEL-F&L, May 17-18, Knickerbocker Hotel, Chicago
WAR MATERIEL, June 5-7, Book-Cadillac Hotel, Detroit
T&M, June 28-29, Bellevue-Stratford Hotel, Philadelphia
WEST COAST T&M, Aug. 24-25, Multnomah Hotel, Portland
TRACTOR, Sept. 13-15, Schroeder Hotel, Milwaukee
AERONAUTIC & ENGINEERING DISPLAY, Oct. 5-7, Biltmore Hotel, Los Angeles
FUELS & LUBRICANTS, Nov. 9-10, Mayo Hotel, Tulsa
AIR CARGO, Dec. 4-6, Knickerbocker Hotel, Chicago
ANNUAL MEETING & ENGINEERING DISPLAY, Jan. 8-12, 1945, Book-Cadillac Hotel, Detroit
AERONAUTIC, APRIL 4-5-6, 1945, Hotel New Yorker, New York

Canadian – May 19

Genosha Hotel, Oshawa, Ont.; dinner 7:00 p.m. Thought Starters for Engineers and Human Beings – Henry G. Weaver, chief historian, General Motors War Activities.

Cleveland – May 8 and 26

May 8 – Aeronautical Meeting at Thompson Aircraft Products Co., Inc.

May 26 – Chagrin Valley Country Club; Annual Golf Outing.

Detroit – May 15

Horace H. Rackham Educational Memorial Building; dinner 6:30 p.m. Speaker and subject to be announced.

Indiana – May 11

Antlers Hotel, Indianapolis; dinner 6:45 p.m. PT Boats – Burns Darsie, Chief engineer, Elco Naval Division, Electric Boat Co.

Metropolitan – May 4

Hotel Pennsylvania, New York; meeting 7:45 p.m. Development Trends in Aircraft Powerplants – Arthur Nutt, vice-president of engineering, Wright Aeronautical Corp. Motion Pictures.

Milwaukee – May 5

Milwaukee Athletic Club; dinner 6:30 p.m. Speaker – A. W. Herrington, chairman of board, Marmon-Herrington Co., Inc.

New England – May 9

Engineers Club, Boston; dinner 6.00 p.m. International Transportation after the War – A. T. Colwell, vice-president, Thompson Products, Inc. Motion Picture – War on Wheels.

Northern California – May 9

Hotel Leamington, Oakland; dinner 7:00 p.m. Locomotive Diesels – E. T. Cuyler, assistant general superintendent, Motive Power, Western Pacific Railroad.

Oregon – Weekly Luncheons

Every Friday, 12:00 noon at Irelands, Lloyds Golf Course, Portland.

Peoria Group – May 16

Jefferson Hotel, dinner 6:30 p.m. War's Impact on Post-War Fuels and Lubricants – William S. James, chief engineer, Studebaker Corp., and president, SAE. Guest – John A. C. Warner, secretary and general manager, SAE.

Philadelphia – May 10

Engineers Club, dinner 6:30 p.m. Speakers: Mrs. Katharine Clark, news commentator, WCAU; Dr. M. Dorizas. Motion pictures – North African and Italian Campaigns.

Southern California – May 5 and 12

May 5 – San Diego Hotel, San Diego; Aircraft Accessories Meeting.

May 12 – Hollywood Roosevelt Hotel, Los Angeles; dinner 7:00 p.m. Aircraft Tooling Meeting. Speaker to be announced.

Texas – May 2

SAE Texas Section participation in 1944 Texas Aviation Conference, A & M College of Texas, College Station. Dinner 6:30 p.m. Speaker – A. T. Colwell, vice-president, Thompson Products, Inc. Subject to be announced.

Twin City Group – May 4

Curtis Hotel, Minneapolis; dinner 6:30 p.m. Engineering Hydraulic Drives into Industrial Equipment – R. G. DeLong, installation engineer, Hydraulic Division, Twin Disc Clutch Co.

Air Transport Engineers, Admitting Odds Are 10-1, Still See Bright Future!

"DON'T sell the airplane short. It has a future beyond anything planned, contemplated, even dreamed today!"

This prognostication seasoned a realistic press interview with SAE Aircraft Engineering Vice-President Ray D. Kelly during the SAE National Aeronautic Meeting. The United Air Lines Transport Corporation's superintendent of development additionally suggested to a group of trade and newspaper reporters that:

- Air transport will continue to supplement, will not replace, ground transportation.

- Air transport engineers enter the post-war with odds 10 to 1 against them because the aircraft engine can move only 10 lb of vehicle and cargo per hp against 100 lb for ground vehicle. However, an air speed which is four times ground speed, cuts the odds to 2½ to 1 if engineers reduce weight, improve fuel economy, develop other operating efficiencies to maintain the plane's inherent advantage of speed.

- Meeting ground competition on a price basis calls for better engineering, designing, manufacturing, and operating equipment, all of which can be facilitated by cooperation and coordination of SAE Aircraft, Aircraft Engine, and Air Transport Engineering Activities.

- Air transport engineers are open-minded about diesel engines, gas turbines, jet propulsion, and helicopters; will utilize any of these when, as, and if it does the job better than present equipment.

- "Fly-Yourself" service at airports is a post-war possibility.

- With the ending of the war and the beginning of opportunity to put emphasis on operations engineering, there is no reason why American airlines should not have schedule reliability and safety in the highest degree.

- The faster an air transport plane is loaded, unloaded, and serviced on the ground, the slower its speed, fuel consumption, and wear can be in the air. Passenger travel speed has been increased four times, but no way has been found to make passengers walk faster on the ground.

- Small, privately-owned planes will be as popular as motor boats after the war, but will be used chiefly for sports and week-end flying, not for long-distance trips – unless airport, communications, and weather-reporting facilities, individual flying ability, develop to an unforeseen degree.

Air Transport Engineering Becomes An SAE Activity

AT its April 7 meeting, the SAE Council approved an amendment to B-39 to include Air Transport Engineering as an Activity of the Society.

Engineers Coordinate Efforts on Hydraulics Standards

Major assignments for engineering and standards projects to the Society of Automotive Engineers come from the Army-Navy Aeronautical Board. A group of Army and Navy specialists who attended a recent joint SAE-National Aircraft Standards Committee Hydraulics Meeting in Chicago, March 22 to 24, include, left to right: G. S. Brick, Naval Aircraft Factory, Philadelphia; E. K. Sosnowski and Nicholas Bashark, AAF Materiel Command, Dayton; Capt. G. E. Davisson, Working Committee, Aeronautical Board; Com. H. J. Marx, Navy Bureau of Aeronautics; L. G. McLaughlin, AAF Air Service Command, Paterson Field, Fairfield, Ohio; N. S. Atwell, AAF Materiel Command, and T. L. Strong, Naval Air Materiel Command

Key hydraulics engineers, among more than 100 who attended the joint SAE-National Aircraft Standards Committee Hydraulics Meeting in Chicago, are shown in this picture. This is one of a series of coast-to-coast meetings to coordinate the opinions of aircraft hydraulic equipment, and Army and Navy opinions about design and standardization of combat equipment. Actual standards work is being done for the Army, Navy, British Air Commission and the War Production Board, by the SAE and the NASC, the former representing hydraulic equipment manufacturers and the latter the aircraft manufacturers. Seated, left to right: F. O. Hosterman, Lockheed Aircraft Corp., Factory B; R. H. Davies, Parker Appliance Co.; L. J. Henderson, Weatherhead Co.; B. R. Teree, Airplane Division, Curtiss-Wright Corp.; J. D. Redding and Gladys Shumate, SAE Staff; Harry Kupiec, Glenn L. Martin Co., Chairman; Frank W. Murphy, Douglas Aircraft Co., Santa Monica, Calif.; and Howard Field, Jr., Los Angeles, Calif. Standing, left to right: John Sasso, Product Engineering; W. V. Fitch, Harvill Corp.; J. Dentraygues, Lockheed Aircraft Corp., Factory A; George A. Rix, Aircraft Accessories Corp.; B. F. Ashton, Electrol, Inc.; Andrew Raffay, Jr., Purolator Products, Inc.; E. F. Loweke, Hayes Industries; B. C. Reciputi, Adel Precision Products Corp.; J. P. Kovacs, Purolator Products, Inc.; P. B. Heineck, Bendix Aviation Corp., Pacific Division, and Gene H. White, Adel Precision Products Corp.

N-A Aero Engine PARTS Cross-Indexed by SAE

AN extensive cross index of all Army-Navy parts used by aircraft engine manufacturers and the engine builders parts numbers for each of the individual parts has been prepared by Committee E-5 on Standards Parts of the SAE Aircraft Engine Subdivision and its three subcommittees. The project was requested of the SAE committee from the Engine Technical Committee of the Aeronautical Chamber of Commerce of America, based upon a request to both the SAE and the ETC from the Working Committee of the Army-Navy Aeronautical Board.

More than 800 engine parts are included in the compilation which has been referred to the ETC for final review and submission to the A-N Board.

The major portion of the task was done by Subcommittee E-5C, under the chairmanship of Douglas Johnson, Jacobs Aircraft Engine Co. Members of the committee are H. C. Beyer, Ranger Aircraft Engines; W. F. Burrows, Aircooled Motors Corp.; M. E. Mills, Wright Aeronautical Corp., and R. E. Schooley, Allison Division, General Motors Corp.

Committee E-5, headed by Mr. Mills, has prepared a list of recommended revisions of the Army-Navy specifications from AN 73 through AN 81 series of aircraft engine bolts.

Another project of the committee is a revision of AN 355 and AN 360, engine nuts, and the AN standards on cotter pins. This also has been submitted to the ETC for review and submission to the A-N Aeronautical Board.

Serving with Chairman Mills and Mr. Johnson on Committee E-5 is J. E. Jackson, Pratt & Whitney Aircraft.

SAE National

Diesel-Fuels and Lubricants Meeting

May 17-18

Knickerbocker Hotel, Chicago

WEDNESDAY, MAY 17

MORNING — Diesel Engine

Adequate Piston Cooling
—Gregory Flynn, Jr., and Arthur F. Underwood, Research Laboratories Division, General Motors Corp.
Prepared discussions by Max M. Roensch, Chrysler Corp., and G. C. Wilson, Universal Oil Products Co.

An Analysis of the Heat Flow into Pistons
—Carl H. Paul, Caterpillar Tractor Co.
Prepared discussions by R. R. Teetor, Perfect Circle Co., and Paul Miller, Electro-Motive Corp.

The Effect of Piston Design on Piston Ring Sticking
—Harry F. Bryan, International Harvester Co.
Prepared discussions by T. M. Robie, Fairbanks, Morse & Co., and Fred Zollner, Zollner Machine Works

AFTERNOON — Fuels and Lubricants

Development of Heavy-Duty Engine Oils for Military Vehicles
—Capt. W. B. Bassett, Ordnance Department, U. S. Army
Prepared discussions by A. O. Willey, Lubri-Zol Corp., and J. B. Kelso, Caterpillar Tractor Co.

Filtration of Diesel Fuel and Lubricating Oils
—Lt. H. V. Nutt, USNR, U. S. Naval Engineering Experiment Station
Prepared discussions by E. G. Gunn, Fram Corp., and E. W. Aldrich, National Bureau of Standards

THURSDAY, MAY 18

MORNING — Fuels and Lubricants

Engine Performance with Low Cetane Number Fuels
—R. C. Williams, Caterpillar Tractor Co., and L. W. Griffith, Shell Oil Co., Inc.
Prepared discussions by R. W. Goodale, Standard Oil Co. of Calif., C. C. Moore, Union Oil Co. of Calif., and H. F. Bryan, International Harvester Co.

Outlook for Post-War Diesel Fuels
—A. L. Foster, Petroleum Publishing Co.
Prepared discussions by A. B. Culbertson, Petroleum Administration for War, and G. H. Cloud, Standard Oil Development Co.

AFTERNOON — Diesel Engine

Some Problems Connected with Diesel Engine Supercharging
—E. W. Wasielewski, McCulloch Engineering Corp.
Prepared discussions by Walter Parrish, Superior Engine Division, National Supply Co., and H. L. Knudsen, Cummins Engine Co.

Diesel Engine Operating Experiences on the Alcan Highway
—Lt.-Col. E. F. Norelius, Office of Chief of Ordnance, Detroit, and Capt. J. L. Cassell, Equipment Development Branch, Office, Chief of Engineers
Prepared discussions by W. F. Aug, Mack Mfg. Corp., and George M. Lange, Timken Roller Bearing Co.

Thursday Evening — DINNER

E. R. Barnard, chairman, Chicago Section

Harold G. Smith, Toastmaster

Post-War Possibilities of the SAE Diesel Engine-Fuels and Lubricants Activities
W. S. James, President SAE

Some Horizons of Diesel Engine Development
REAR-ADMIRAL EARLE W. MILLS,
Assistant Chief, U. S. Navy Bureau of Ships

ABOUT SAE MEMBERS

cont. from p. 32

SAE members who have received recent changes in company status are: **ARTHUR BAITZ,** Sterling Engine Co., from test engineer in the Buffalo plant to foreign service representative, in which capacity he may be reached at Navy 100, c/o Fleet Post Office, New York City; **FRANCIS A. DUGAN,** Ranger Aircraft Engines, Farmingdale, L. I., N. Y., from designer to design representative of cost control department; **NAT A. KLIPPER,** American Stock Gear Division, American Gear & Mfg. Co., Chicago, from chief engineer to works manager of the machine shop; **DONALD R. HEBERT,** Wright Aeronautical Corp., Paterson, N. J., from flight test engineer to field engineer; **ALEXANDER C. WALL,** P. R. Mallory & Co., Inc., Indianapolis, from the engineering department to chief engineer of the Ignition Division; **ROBERT U. WHITNEY, JR.,** Elastic Stop Nut Corp., Union, N. J., from mechanical engineer to product engineer; **KENNETH CAMPBELL,** Wright Aeronautical Corp., Paterson, N. J., from project engineer to senior project engineer; **ANDREW N. SMITH,** test engineer for General Electric Co., has been transferred from the branch at Erie, Pa., to Schenectady, N. Y.; **D. R. McINTYRE,** development engineer for Atlas Imperial Diesel Engine Co., has been transferred from the Oakland, Calif., to the Chicago branch; **WILLIAM W. KOENIG,** Sperry Gyroscope Co., Inc., Brooklyn, N. Y., from methods engineer and supervisor to manufacturing engineering product supervisor; **JOHN R. CARPENTER,** Insuline Corp. of America, Long Island City, N. Y., who has increased his duties as production engineer to include work on product designing, and is also chief engineer of the National Electronic Mfg. Corp. in Queens; and **HAROLD F. SUTHERS,** Houde Engineering Division of Houdaille-Hershey, Inc., Buffalo, N. Y., from hydraulic test engineer to test engineer in charge of the hydraulic laboratory.

WILBUR T. DUNCAN, JR., Sun Oil Co., Marcus Hook, Pa., from CFR engine operator to technical engineer of gasoline production; **LeROY YATES POND,** U. S. Naval Air Station, Corpus Christi, Tex., from assistant foreman of engine overhaul to general foreman of the same department; **JAMES W. JOYCE,** district manager of Faber Laboratories, Inc., has been transferred from the Los Angeles to the San Francisco branch; **KINGSLAND HOBEIN,** Wright Aeronautical Corp., Paterson, N. J., from field engineer to senior field engineer; **RAYMOND D. SCHMITT,** White Motor Co., from assistant technical service manager in the Cleveland office to service manager in the Los Angeles branch; **GEORGE M. LANGE,** Timken Roller Bearing Co., from assistant division manager in Milwaukee to engineer in the Canton (Ohio) branch; **HARRY N. TAYLOR,** United Air Lines Transport Corp., from development engineer in Chicago to project engineer for powerplants at the Cheyenne Repair Base; **HOWARD H. OLSEN,** Ranger Aircraft Engines, Division Fairchild Engine & Airplane Corp., Farmingdale, L. I., N. Y., from field service supervisor to sales engineer; **JOHN B. WILEY,** Beech Aircraft Corp., Inc., Wichita, Kan., from supervisor of production planning to assistant foreman of pro-

duction planning and shipping; **GLENN R. GRAHAM**, Cleveland Graphite Bronze Co., Cleveland, from aircraft field engineer to resident engineer in the Detroit office; **W. WESLEY MILLS**, Mir-O-Col Alloy Co., Los Angeles, from general manager to director of research and metallurgical consultant; **WILLIAM C. OSBORN**, Northrop Aircraft, Inc., Hawthorne, Calif., from superintendent of outside production and subcontracts to manager of the outside manufacturing department; **ARTHUR C. BLOOMER**, Continental Motors Corp., Dallas, Tex., from experimental tool engineer to specifications engineer; **LUCILE H. SERGEANT**, Wright Aeronautical Corp., Paterson, N. J., from junior engineer to test engineer; **WILLIAM B. SKETCH**, from project engineer at Continental Aviation & Engineering Corp. to senior project engineer and chief draftsman at Continental Motors Corp., Detroit; **HAROLD S. HANSEN**, Allison Division, Indianapolis, from cold weather testing department representative to experimental test engineer; **A. B. CREVELING, JR.**, American Car & Foundry Co., Berwick, Pa., from electrical engineer in St. Charles, Mo., to automotive electrical engineer in the Pennsylvania plant; and **KENNETH M. CLOUD**, Continental Motors Corp., Muskegon, Mich., from project engineer to chief draftsman.

SAE members who have been named to the recently-formed Airworthiness Requirements Committee (ARC), which is under the Airplane Technical Committee of the Aeronautical Chamber of Commerce of America, include: **LEON L. DOUGLAS**, chief of structures at the Johnsville (Pa.) plant of Brewster Aeronautical Corp.; **A. P. FONTAINE**, assistant director of engineering of Consolidated Vultee Aircraft Corp., Vultee Field, Calif.; **CLARENCE L. JOHNSON**, chief research engineer of Lockheed Aircraft Corp., Factory "B," Burbank, Calif.; and **DR. ROBERT J. NEBESAR**, vice-president and chief engineer of Universal Moulded Products Corp., Bristol, Va.

HENRY FORD II was recently elected executive vice-president of Ford Motor Co., second in authority to **HENRY FORD**, founder and president of the company. It was the second promotion in three months for the late **EDSEL FORD'S** son, who was named sales vice-president in January this year.

SELBY F. GREER, formerly service engineer for Borg-Warner Service Parts Co., Chicago, is now assistant general sales manager for Kellogg Division of American Brake Shoe Co., Rochester, N. Y.

MAURICE A. THORNE is now associated with Fisher Tank Division of General Motors Corp., Detroit, as chief engineer in the original design department.

BURTON W. ELGIN has been promoted to a major in the U. S. Army, and may be reached at A. P. O. 149, c/o Postmaster, New York City.

MICHAEL J. REARDON, JR., formerly liaison engineer for Chrysler Corp., Chicago, is now in the U. S. Army, stationed at Aberdeen Proving Ground, Md.

G. F. STACY has been named production engineer at Chrysler Tank Arsenal, Detroit. Mr. Stacy had been a draftsman for Chrysler Corp., Highland Park, Mich.

SAE NATIONAL War Materiel Meeting

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Book-Cadillac Hotel, Detroit

June 5-7

★

MONDAY, JUNE 5

MORNING — Passenger Car

Hydraulic Transmissions for Motor Vehicles
—*A. H. Deimel, Spicer Mfg. Corp.*

An Improved Indicator for Measuring Static and Dynamic Pressures
—*C. E. Grinstead, R. N. Frawley, F. W. Chapman, and H. F. Schultz, Research Laboratories Division, General Motors Corp.*

AFTERNOON — Materials

Materials for Preparation and Preservation of Vehicles and Component Parts for Storage and Shipment
—*C. E. Heussner, Chrysler Corp.*

New Chemical Surface Treatments for Improved Material Performance
—*W. M. Phillips, Research Laboratories Division, General Motors Corp.*

EVENING — Production

The General Motors Diesel Unit Injector
—*C. W. Truxell, Jr., Diesel Equipment Division, General Motors Corp.*

Some Aircraft Engine Production Methods
—*M. M. Holben, Wright Aeronautical Corp.*

★ ★

DINNER

Tuesday Evening

O. E. Hunt, Toastmaster

W. S. James, President SAE

REAR-ADMIRAL H. G. TAYLOR, USN,
Superintendent of Civil Engineers, Area 5, Bureau of Yards & Docks

Automotive Materiel in Navy Combat Service

TUESDAY, JUNE 6

MORNING — Truck and Bus

Lessons Learned from Aircraft Engines Applied to Heavy-Duty Ground Vehicle Engines
—*V. C. Young, Wilcox-Rich Division, Eaton Mfg. Co.*

AFTERNOON — Passenger Car

Problems Involved in Spark-Ignition Fuel-Injection Engines for Ground Vehicles
N. N. Tilley, Studebaker Corp.

A Cleaner Engine
—*John G. Wood, Chevrolet Motor Division*

WEDNESDAY, JUNE 7

MORNING — Materials

Wartime Developments in the Heat Treatment of Steel and Their Effect on the Design, Production and Performance of Automotive Equipment
—*H. W. McQuaid, Republic Steel Corp.*

Improvements in Ferrous Castings Influencing Their Future Use
—*G. Vennerholm and E. C. Jeter, Ford Motor Co.*

AFTERNOON — Truck and Bus

Possibilities of Aircraft-Type Structures in Ground Vehicles
—*Mac Short, Lockheed Aircraft Corp.*

Business Session—8:00 p. m.

EVENING — Passenger-Car Body

The Practical Post-War Car
—*Brooks Stevens, Industrial Designer, Milwaukee, Wis.*

Aviation and the Post-War Car
—*W. B. Stout, Stout Research Division, Consolidated Vultee Aircraft Corp.*

AERO Meeting

cont. from p. 23

those intent solely on providing him with dependable engine operation, make necessary complete flexibility of the automatic power control.

Water injection, once whispered about, has at last become a subject for newspaper accounts and description. Use of water injection equipment presents new control problems. Full advantage of water injection is possible only with power controls designed to provide complete protection to the engine, engineers were warned.

Hydraulic units offer a simple and direct solution to the many problems of coordinating engine functions into simple and reliable automatic controls providing protection to the engine itself, and still permitting complete manual operation when desired and emergency power when necessary, according to one speaker. When applied directly to an engine it offers a compact and rugged system of low vulnerability. Where remote operation of sensing or actuating means are required, various elements of the hydraulic control can be advantageously combined with electric or electronic units.

Another speaker pointed out that for many years it has been the desire of airplane designers and operators to prerotate landing wheels so as to effect economics in design and maintenance. The mere physical operation of rotating a wheel is a very simple matter indeed, but additional weight is involved. A year earlier another paper on this subject was presented at the SAE Aeronautic meeting, when results obtained by Boeing Aircraft Co. on a pair of 19 x 23 tires equipped with flexible vanes was reported. By the addition of only 5 lb of material to the airplane, a prerotation of 68% was obtained.

The author recounted subsequent developments and wind-tunnel tests, and reported that service tests are being made as the work progresses. He felt that considerable improvement in landing performance could be thus achieved.

However, violent disagreement was disclosed in discussion when eminent aircraft engineers declared that prerotation was neither desirable nor safe. Some maintained that tire tread wear was not an important factor, that the brakes were called upon to do too much work, and that the resonance of an unbalanced rotating wheel after take-off and while being retracted, may cause severe wing vibration.

Despite a great deal of work done on development of priming fuels and priming techniques for cold starting of engines in low temperatures, the only solution to date, several engineers agreed, was to have the airplane kept in a warm hangar. The exigencies of war required quick take-off, one pointed out, but urged accessory engineers to continue whatever projects they were developing in the interest of solving this problem.

With the large number of parts and accessory manufacturers in the field providing equipment for the military services, the problem of marking and identifying replacement parts was cited by a Navy spokesman as one needing solution. He pointed out that many a combat ship is kept on the ground because of the multiplicity of identifying methods commonly used. This is particularly true in repair depots in those areas where corrosion is serious, he said. Frequently sketches must be resorted to in lieu of parts numbers, he reported.

Combat experience has shown that American-made radiators stand up extremely well, another Navy officer, recently returned from combat duty, reported. Manufacturers of heat exchangers were lauded by him and several other speakers and discussers for having brought the weight of units down, having designed them to fit small and irregular spaces in the airplane, and for achieving high overall efficiencies of the units.

On the question of storage of fuels, he pointed out that although drums are an inefficient method, they must be resorted to in nearly every combat zone. However, the Navy has built numerous tank farms and the fuel is unloaded directly from ships wherever possible.

SAE

NATIONAL

TRANSPORTATION & MAINTENANCE

MEETING

June 28-29 ***Bellevue-Stratford Hotel***
Philadelphia

THE War Materiel Meeting, scheduled for June 5-7, Detroit, has been designated officially by the SAE Council as the semi-annual meeting of the Society for 1944.

Reprinted from

METALS and ALLOYS

The Engineering Magazine of the Metal Industries

February, 1944

How To Be A Great Technical Society

A truly unique honor has been recently conferred by the Ordnance Department on the Society of Automotive Engineers – the presentation to the Society of the Department's Distinguished Service Award "in recognition of outstanding and meritorious engineering advisory services in war and peace; in design, manufacture and maintenance of ordnance matériel."

This award is the first of its kind ever presented to any engineering society and is richly deserved. It is the best justification, if any were needed, of adherence by a technical society to a policy and program that put service to the Nation and to its professional field far ahead of self-aggrandizement, promotion and the enlargement of its treasury beyond necessity. It is on-the-record proof that a society's headquarters staff can better serve the ends of victory by quietly and efficiently devoting its energies to the solution of specific and vital technical problems through committee action on a mass scale than by any other means.

A technical society can do many things in its zeal for growth and influence that may in time nullify its actual contributions and ruin its prestige. SAE has carefully avoided these practices and pitfalls. It does not, for example, seek new members just to add to the Society's size, and is interested in intensively developing only its own clearly-defined field; it does not eye what may appear to be greener pastures close by as possible additions to its scope.

As an editor of an engineering magazine we naturally are sensitive to the publishing policies of other technical journals. For *SAE Journal* we have nothing but the highest praise. In using the limited paper supply made available to it, the Society has considered the maintenance of its editorial services to its members of greater importance than the unrestrained expansion of advertising volume in its magazine.

In short the SAE in all its projects has put engineering service above profit. The receipt of the Ordnance Department's unique award demonstrates that this policy contains the elements of greatness and is recognized as such. It is, indeed, a policy that could well be emulated by those few technical societies who may now be moving in a somewhat different direction.

NEW MEMBERS Qualified

These applicants who have qualified for admission to the Society have been welcomed into membership between March 10, 1944, and April 10, 1944.

The various grades of membership are indicated by: (M) Member; (A) Associate Member; (J) Junior; (Aff.) Affiliate Member; (SM) Service Member; (FM) Foreign Member.

Baltimore Section: Lewis L. Cunningham (M), Ensign EV(S) John Edgar Mann (J), Armour K. Milner (J).

Buffalo Section: Walter R. Woodward (J).

Canadian Section: Emerson L. Chant (M), Ronald Grundy Hillier (M), Carlyle Maunder (A), John N. Nickell (A), Lloyd W. Nourse (A).

Chicago Section: John Erich Henningsen (M), George Henry Miller (J), Frank Sailer (M), Llewellyn W. Welch (A), Harold Eugene Wharton (J), John S. Yule (M).

Cleveland Section: George T. Beverley (A), Alfred R. Bobrowsky (J), James L. Caputo (J), Vollmer W. Fries (A), Witold S. Gwizdowski (J), William James Kovelan (J), Joseph E. Kruse (J), Alvin Louis Ledel (J), La Vern R. Meyer (J), Joseph Henry Richards (J), John C. Sheppard (A), J. R. Thompson (M), Kenneth R. Treer (J), F. T. Turner (A), D. C. White (A), Arthur E. Wolfe (A).

Detroit Section: Victor H. Bernardi (S M), Edward E. Blaurock (M), James H. Booth (M), James Thomas Bowling (J), Fred A. Buchda (A), George A. Chadwick (M), William John Clark (J), Erwin F. Collins (M), Joseph H. Coombes (M), Bly A. Corning (J), Charles L. Donlon (J), Julius Dusevoir (M), John Dutton (A), Walter R. Eames, II (J), 1st Lt. Theodore M. Fahnestock (S M), Ray H. Farmer (M); Christian T. Feddersen (M), Major Richard A. Fox (J), Carl N. Hanke (M), J. V. Hendrick (M), Arleigh J. Hess (M), Clifford B. Higgins (M), Wm. H. Horn (M), Fantin Iavelli (M), Dwight C. Maier (M), Wallace C. Manville (M), George P. Nelson (M), Charles Armando Paganini (J), Edward Lupton Page (J), H. W. Peters (A), John Ross (M), Henning William Rundquist (M), Walter N. Scharff (A), Walter F. Seifert (A), Carl A. Stamm (M), M. B. Terry (A), F. Russell Valpey (A), Vaino J. Vehko (J).

Indiana Section Lorraine J. D. Frazer (M), (Miss) Roberta Harper (J), Walter H. Kluck (A), Paul Ellis Parsons (M).

Kansas City Section: Royal C. Jackson (J).

Metropolitan Section: William Brown Alexander, 5th (J), Earl W. Allington (A), Wm. H. Bacon, Jr. (A), Robert Arnold Brayman (J), James E. Cambria (A), David X. Clarin (A), Kenneth L. Fitts (A), Irving Forsten (J), William H. Joachim (A), Francis Angus Kimmons (M), James Otis King (J), Augustus B. Kinzel (M), Major William O. McGuigan (A), John G. McNab (J), Beal P. Moore (J), Ted C. Ning (J), Ford M. Smith (A), Eugene J. Trunk (J), Harvey W. Welsh (J), Norman E. Woldman (M).

Mid-Continent Section: F. M. Simpson (M).

Milwaukee Section: Ervin L. Dahlund (M), G. J. Retzlaff (A).

Mohawk-Hudson Group: Robert H. Craig (A), Charles Z. Smith, Sr. (S M).

Muskegon Group: Julius Fairfield (A), Francis W. Feeney (A), Jacob Feenstra (A), Peter M. Hansen (A), Albert M. Port (A), Harry E. Potter (A), Herbert I. Steinman (J), William VanDam (J), Gerald D. Whiting (J).

New England Section: James Goldstein (A), Raymond McPherson (A), Stanley William Mikulka (J).

Northern California Section: Carroll I. Henwood, Jr. (J), Sidney W. Newell (J), Kenneth W. Self (A), Irving M. Tick (A).

Northwest Section: Delmar B. Carmel (A), Marvin H. Greenwood (M), Carl August Martens (A), Howard N. Sill (J).

Oregon Section: George H. Wilson (A).

Peoria Group: John P. Carroll (M).

Philadelphia Section: George C. Abbe (M), Edward E. Clark (A), William E. Cobey, Jr. (J), Otto K. Duhrkoff (A), Oscar Epstein (J), Raymond B. Landis (J), Hugh J. Mulvey (M), Kenneth George Roth (M), John R. Winkle, Jr. (M).

Pittsburgh Section: Arthur Wayne Aspin (M), C. A. Burkhalter (M), Thomas G. Stitt (M), E. T. Walton (M).

St. Louis Section: Olin J. Eickmann (M), Norman H. Foss (J), Harris L. Hendricks (J), Anthony Mikulus (A).

Southern California Section: Charles M. Barnhart (M), Everett Nicholas Ericson (A), Major Servais Louis Evrard (A), Wayne Ewing (M), Edmund L. Flood (A), Harry L. Freeman (A), Arthur W. R. Hix (J), John W. Horner (J), John Jauregui (J), Robert W. Lindberg (J), Henry Mandolf (M), W. Wesley Mills (M), James L. Morgan (A), Cleighton N. Mosher (A), David L. Penn (J), Justin E. Pequegnat, Sr. (A), B. G. Reed (M), Solar Aircraft Co. (Aff.), Reps: Harry A. Campbell, Wm. C. Heath, Grant B. Hodgson, John A. Logan, Robert Magness, Paul Arthur Pitt. Walter S. Taylor (J).

Southern New England Section: Leslie H. Brewer (M), Edmund Karl Brown (M), Perry A. Clark (J), Edward Feldman (A), Arthur J. Guertin (A), Carl T. Hewitt (M).

Southern Ohio Section: Major John F. Beeler (S M), M. George Brown (M), Lt.-Col. George Curtis Crom (S M), William D. Hazlett (M).

Syracuse Section: Hubert E. Kaye (M), Jesse E. Sero (M).

Texas Section: Andrew Walter De Shong (A), Francis Bonneau Johnson (M).

Twin City Group: George S. Johnson (J), Martin E. Leadon (M), Adolph O. Lee (J).

Washington Section: H. M. Conway, Jr. (J), Aaron Loveridge Mercer, Jr. (J), David K. Morrison (J), C. Robley Patterson (A), Herbert A. Roberts (A).

Wichita Section: E. W. Schroeder (J).

Outside of Section Territory: Eugene C. Eastman (A), M. W. Huber (M), Norman L. Johnson (A), Angus H. McGregor (A), Ensign Hugh Rainey Melrose (A), 1st Lt. Morris George Munson, Jr. (J), Walter C. Thomas (J), Glen C. Vanderberg (M).

Foreign: Andrew Mathis Kamper (F M), (England), Gosta Fredrik Peterson (F M), (So. Africa).

APPLICATIONS Received

The applications for membership received between March 10, 1944, and April 10, 1944, are listed below. The members of the Society are urged to send any pertinent information with regard to those listed which the Council should have for consideration prior to their election. It is requested that such communications from members be sent promptly.

Baltimore Section: Frank M. Gorsuch, Jr., Joseph A. Jarboe, John C. Kammerer, Sr., Thomas M. Walsh.

Buffalo Section: Charles T. Grigg, J. A. Lux.

Canadian Section: Frank J. Lysaght, Robert B. McIntyre, Frank Harold Vercoe, Frank Williams, Lester William Ziegler.

Chicago Section: Robert E. Allen, Clyde A. Brown, Robert G. Brooks, Harry C. Carroll, Albert F. Christian, Clifford Lysle Haseman, W. G. Haughton, John C. Hayden, Theodore J. Jenkins, Joseph T. Lundquist, Robert G. Moyer, Torg Primdahl, Lt. (jg) Adelbert E. Randall, J. A. Reinhardt, Henry W. Saly, John P. Stover.

Cleveland Section: Edward K Brown, Raymond R. Dailey, John V. Eakin, Stephen Fedak, Louis H. Grutsch, Floyd Y. Miller, J. Frederick Norton, Herman Palter, Clifford F. Salow.

Colorado Group: Walter W. Carlson, Arthur M. Dahm, Roy F. Mitchell.

Detroit Section: Robert A. Carrier, Thomas Couper, Walter M. Davies, N. A. Gibson, Adelbert J. Gogel, Harold M. Hart, Ralph L. Johnston, Vernon Alvord Knox, William Hart Landrum, E. F. Mayne, Taine G. McDougal, H. B. Miller, H. William Overman, George P. Pajares, Glen Alan Smith, Gerald W. Stanke, H. Richard Steding, III, Harold M. Stephen, James P. Tate, William O. Watson, W. Eric Wilson, Henry Delmer Yerby, Richard Calvin Yetter, Edward W. Zingsheim.

Indiana Section: William Montelle Carpenter, R. J. McCracken, Richard E. McKenna.

Kansas City Section: T. A. Bradley, Ralph L. Ellinger, Charles C. Phelan, R. M. Sandford.

Metropolitan Section: Louis M. Barish, Carl H. Borner, Everett Henry Cargen, Jr., John V. Dunn, Frederick W. Fleischhauer, Wilbert W. Frank, Norman Frederick Hall, Edward Kirkland Hine, Teng mei Lee, Edward R. Lindeke, Jr., Joseph W. Mallach, James G. McIntosh, George C. Miller, Claude E. Moore, David Muldoon, Jr., Stephen George Orban, Nelson J. Orr, William F. Payne, Robert Lloyd Simms, Dr. A. A. Somerville, Alfred Bertin Steinau, Arthur M. Watkins.

Mid-Continent Section: William E. Richard.

Muskegon Group: Arthur A. Abel, Edward J. Adams, Raymond Francis Allison, Robert Harrison Barr, Harold C. BeMent, Guy M. Benham, Paul F. Bergmann, Andrew H. Boerger, George G. Boyce, Harry C. Buttrick, Dana A. Campbell, Fred J.

Carskadon, William Cayan, Palmer C. Dolph, Rudolph F. Flora, Joseph Gaia, Raymond Kenneth Johnson, Warren F. Kalkstine, Carl Paul Kloss, Joseph T. Kulhavy, John E. Long, Frank McGowen, Paul Albert Pfenning, George L. Reynolds, Bine W. Rollin, Jacob Schalk, Joseph C. Woodford, Harold C. Scholtz, Lloyd Robert Schubert, Herman F. Stapel, David J. Vail, Ernest Wagner, John L. Walker, Edward Wickland.

New England Section: Earle F. Baker, John A. Connor, Howard Dick Ingalls, Tsui-chu Mao, Edward G. Moody.

Northern California Section: James J. Duffy, John C. Fay, C. Hayes Gowen, Joseph J. Nunn, William M. Staples.

Northwest Section: Halsey W. Huron, William Henry Lizotte, Weston H. Myers, A. G. Strahan.

Oregon Section: Roy B. Alexander, William Craig Carroll, John L. Hall, Harry F. Manning, Pointer-Willamette Co., Capt. Lewis S. Russell, Jr., Edward C. Wagner, Robert J. Wilhelm.

Peoria Group: Carl L. Kepner.

Philadelphia Section: William Randolph Berry, James R. Custer, Nicholas Reitter, Jr.

Pittsburgh Section: William P. Getty, Merlyn Joseph Patrick, H. L. White.

Southern California Section: James Coolidge Carter, Robert C. Davidson, Holley B. Dickinson, Chris E. Ema, Jule Gordon, Walter C. McCue, William C. McFadden, William George Nuttman, Eric Olsen, Richard S. Orchard, Roger Spicer Shute, Victor A. Smith, H. Ray Sullivan, Lloyd E. Tomlinson, Edgar Paul Troeger.

Southern New England Section: Chester Hilton Cooper, William W. Doolittle, Jr., Melvin E. Geiser, John Richard Leon, F. M. Morency, Anthony Vincent Pond, Lawrence Peter Tanguay, Gordon Bryant Taylor, Sumner L. Young.

Southern Ohio Section: George V. Altermatt, Henry Joseph Antosz, Thomas A. Bragdon, Joseph W. Brown, David Cameron, Merlyn M. Culver, Roy C. Hauck, William M. Myler, Jr., Elmer C. Slaughter, Everett D. Stephens.

Syracuse Section: Frank F. Cordone, Donald L. Kidd, James A. Robbins, John P. Rogers, Ford Wilders.

Texas Section: Gerald William Keller, Lawrence McInerny.

Twin City Group: Richard L. Acton, F. H. Funke, Edward Heath Woehrle.

Washington Section: Joseph P. Gaulin, Douglas Gordon Moffitt.

Wichita Section: James George Alexander, M. L. Carter.

Outside of Section Territory: Lt. Louis A. Edelman, Hector William Francis, Fraser Jamieson, M. Colvin Kemp, Harvey R. Knoll, C. V. Lisle, Jan R. Major, William F. Ritcheske, Jr., Michael Sarullo, Roy Simmonds, B. F. South, C. Kenneth Strickland, Walter B. Winne.

Foreign: Charles Dunstan Brewer, England, Charles Evelyn Randall Franklin, Africa, George Mann, England, Edward Henry William Partridge, England, Walter Steuer, England.

Technical IDEAS for ENGINEERS

★ ★ ★

DIESEL in Competition

cont. from p. 27

present low price of the fuel used. Due to the better part load economy of the diesel, he said, actual mileage obtained in highway operation is often twice as great as in similar operation with the gasoline engine, since the latter engine must be controlled by throttling the mixture of fuel and air before it enters the engine cylinder. In the case of the diesel, a full charge of air enters the cylinder under all conditions of loading, the charge ignites at several points simultaneously and continues to burn during the period of injection.

The speaker listed the following factors as unfavorable to the diesel in comparison with the gasoline engine: (1) structural weight, (2) weight per cubic inch displacement, (3) bmep, as the diesel requires excess air to prevent waste of fuel. This may be offset by supercharging, and (4) rpm, which is limited by the time required for adequate mixing of the fuel and air in the cylinder and the factor of ignition lag. This accounts for as much as 0.002 sec delay and it has not been found possible to reduce this below 0.001 sec (30-deg crank movement at 3000 rpm). Dr. Schweitzer believes the answer for the diesel is 2-cycle operation. This doubles the number of power strokes at any given speed, and gives the diesel the ability to make use of pure air for scavenging. He further predicted that the high-speed post-war diesel will be 2-cycle or the supercharged 4-stroke type.

He then discussed the various types of scavenging – cross flow, when the ports are at the head of the cylinder but the intake and exhaust are on opposite sides; loop, when the ports are on the same side; and uniflow design, when the air enters through ports uncovered by the piston at the end of the expansion stroke while the exhaust gases escape through poppet valves at the head end.

Asked about progress in the control of odor and smoke, the doctor stated that the development of a smoke meter now on the market is the result of research on the subject. Both smoke and odor are abated by proper control of temperature conditions.

Regarding the availability of diesels in small sizes suitable for electric generator drives, the speaker said that 5- and 10-hp units are available, but smaller sizes are not practical due to temperature conditions.

Dr. Schweitzer asserted, when asked whether improvements in combustion chamber design might not be helpful, that the maintenance of a high temperature is important and that divided chambers have more cooling surface and tend to result in harder starting and more difficult idling. He went on to say that the "long suit" of the divided chamber is that it permits the use of the pintle-type nozzle, which is satisfactory in engines having adequate turbulence.

Dr. Schweitzer characterized the use of fuel additives to promote ignition as effective "from a technical point of view." Their action is the opposite from that of the lead compounds used to increase the octane number of gasoline and the lower flash point resulting from their use introduces a hazard in the handling of the fuel.

The speaker considered it distinctly possible that a gas engine using 90-100 octane fuel compares very well with the best of the diesels – particularly at full load. He stated that fuel economy of 0.40-0.42 lb per bhp-hr is possible experimentally and 0.50 lb per bhp hr in commercial operation. He also spoke of supercharging diesels as a promising development, with the possibility of 40% increase in power at no sacrifice in fuel economy.

He feels that fuel injection will eventually replace the present-day principle of carburetion. He outlined the major characteristics of a new semi-diesel development as follows: liquid-cooled, radial, 2-cycle, spark ignition, and fuel injection.

War Progress Presages Thrilling Peace

by A. W. HERRINGTON
Marmon-Herrington Co., Inc.

▪ Washington, March 13

(Excerpts from paper entitled "Our Part in Post-War Industry")

WARTIME developments in electronics will bring greater changes to our everyday post-war life than did the coming of the radio. As the carefully hidden military secrets of this war are gradually permitted to come to public attention it is easy to stir one's imagination as to the possibilities of peacetime application.

The wireless transmission of electrical energy is a not too far distant possibility. Great strides are also being made in further unfolding the complicated chemistry of the hydrocarbon series of compounds. The octane ratings of our motor fuels are at present outstripping the ability of our motor designers to utilize fully these new sources of energy. Small laboratory test engines capable of from 500 to 850 imep are already in operation.

As motors and fuels develop, our airplanes are climbing higher into the stratosphere, and more problems rise to confront us. Reduction of the ton-mile cost of air cargo transportation is determined by the speed and the laden to unladen weight ratio. There seems little hope of any radical change in the specific weight of the materials out of which an airplane can be built. The one factor still open to attack is the volume of fuel required to be carried and the energy content of this fuel.

Our knowledge of aerodynamics is also undergoing a major revision and revolution. When propellers are no longer efficient we must turn to orifice or jet propulsion. Such sources of propelling, exceedingly efficient at high altitudes, have presented some low-altitude problems we are just on the verge of solving.

The airplane which can be flown by an individual of average physical qualifications is even now available.

As the substratosphere has been brought into successful military use it will correspondingly contribute much to post-war commercial application. Up over 20,000 ft we enter a world free from storms and air disturbances.

Airplanes carrying cargoes of perishable foods will not be burdened with weighty and power-consuming refrigeration systems. The cargoes can be flown quickly into the substratosphere where the low temperatures will be fully adequate to meet all of the demands of the transportation of such loads.

In the field of chemistry, new catalysts have been developed. Synthetics have made progress under the impetus of shortages caused by military action.

In the metallurgical field there has been corresponding progress. Physical properties of our basic steel have been improved to the point where its possible use is materially expanded. Beryllium and boron are coming into use as alloying agents. Beryllium nickel and beryllium copper have assisted in the solution of one of our aviation headaches. The light metals, aluminum and magnesium, have had a phenomenal development. Glass, too, has been developed more in the past four years than in all of its prior history.

New methods, redesign of farm machinery, new and more powerful fertilizers will reduce the farmer's man hours of effort and increase the production value of his work hour.

How can a business man best take advantage of these opportunities the engineer has made available to us?

Our post-war economy and national and company income stems right back to orders and customers. A business man should ask himself, not only what am I going to *sell*, but also what am I going to *buy?* Having obtained orders we need expect no difficulty with facilities.

The position of labor in industry has been revolutionized within the past eight years. It augurs well for the future that labor has been giving ample evidence of rising to meet the new responsibilities which have been thrust upon it.

In any discussion of capital we must revert to the renegotiation act. The failure to provide for adequate corporate reserves for post-

war conversion may yet have serious consequences. The wages of capital are profits. Taxes at present take such a high percentage of the wages available to capital that there remains such a low incentive that capital has gone into hiding. This problem must be solved to free our post-war economy.

If we can think of taxes in terms of dollars instead of in percentages of income this problem can be solved, and it will be solved by the combined effort of labor, industry, and the farmer.

U. S. SYNTHETIC RUBBER OUTPUT STILL MARGINAL

by R. P. DINSMORE
Goodyear Tire & Rubber Co.

■ Cleveland, March 13

(Excerpts from paper entitled "Some General Aspects of Synthetic Rubber")

IN February of last year the rubber director estimated total rubber requirements for 1943 at 612,000 tons and the synthetic production at 276,000 tons. The actual consumption was nearly 100,000 tons lower, while the synthetic production was only 40,000 tons less than the estimate. In his report of Nov. 10, 1943, the rubber director estimates the 1944 requirements at 953,000 tons and production plus imports at 899,000 tons. The military demand is 390,000 tons or 41% of the total. It is also noteworthy that last year the country processed 488,000 tons, while this year the plan calls for processing 740,000 tons. This is a 52% increase, and it is doubtful if increased processing capacities will be available in time to realize this figure.

Many may wonder why there should be a processing problem in the rubber factories since they were able to process 775,000 tons of rubber in 1941. In order to give a basis for comparison, I am listing the rubber processed, in successive years, plus one-half the reclaimed rubber.

Rubber and (unpigmented) Reclaim Used in U. S. A.

	1941	1942	1943	Est. 1944
Crude ...	775,000	376,000	318,000	155,000
Synthetic	6,000	18,000	170,000	585,000
Reclaim (½)	132,000	142,000	153,000	138,000
Total ...	913,000	636,000	641,000	878,000

It would appear that 1944 would offer less difficulty than 1941, but there are several basic reasons why this is not true:

1. Many special war products, such as fuel cells, require more labor, processing, and floor space, per pound of rubber, than pre-war standard products.

2. Synthetic requires more preparatory processing than crude and some special equipment.

3. Available labor is less skilled and skilled labor is less efficient than pre-war.

4. Equipment maintenance is more difficult and causes more delays, because of continuous running for a long period and because replacement parts are not readily available.

5. Delays in production are caused by frequent changes in product to take care of the changing rubber balance.

The effect of these factors is demonstrated by the fact that in 1943 when the crude-reclaim factor was only about 70% of 1941, practically every rubber factory in the industry was running to full capacity. Much has been done to balance tire plants by moving to new locations. However, a large amount of new tire equipment and building capacity is still needed to provide added requirements.

Since we cannot use more than 155,000 tons of crude and end the year with a minimum stock of 50,000 tons, we must bring down our ratio of crude to synthetic as rapidly as possible. Dealing only with rubber processed in this country, our ratio of crude to synthetic shows the following actual values for 1943 and the necessary maximum values for 1944:

Ratio, Crude to Synthetic

1943		1944	
1st ¼	12.2	1st ¼	0.40
2nd ¼	5.2	2nd ¼	0.30
3rd ¼	1.5	3rd ¼	0.23
4th ¼	0.62	4th ¼	0.18

This contemplates the use of 10,000 tons

per month of crude during the last quarter of 1944. If the net imports for 1945 are no higher than for 1944, the crude consumption after 1944 must be cut to about 5000 tons per month.

The question is frequently asked whether general-purpose synthetic rubber will continue after the war. The answer depends upon:

1. Government attitude towards imports of crude rubber as a factor in international relations.

2. The quality of the synthetic relative to natural rubber.

3. The relative cost.

There is, however, a need for a continuing synthetic industry on an adequate scale as a natural safeguard. Also, the production of such a basic raw material by chemical synthesis offers the advantage that endless modification is possible, which means a more adaptable and useful material. It is by such means that our standard of living may be raised.

Seek Coolant Pumps With Constant Flow At Higher Altitude

by E. T. VINCENT
Continental Aviation & Engineering Corp.

■ 1944 Annual Meeting

(Excerpts from paper entitled "A High-Altitude Coolant Pump")

THE liquid-cooled engine depends on the satisfactory supply at all times of a suitable coolant fluid in sufficient quantity to remove the heat passing through the walls of the cylinders; therefore, for a given coolant, there is some minimum rate of flow for each set of engine conditions, any reduction below this minimum could result in engine failure. It may be assumed, therefore, the desirable delivery characteristic of a coolant pump is one that has a constant rate of circulation from ground level to the critical altitude of the powerplant.

The circulating pump is always of the centrifugal type, gear driven at some constant ratio from the engine; thus speed variation of the pump itself cannot be employed as a variable to obtain the desired flow under maximum engine speed and power, without additional undesirable complications.

Coolant Pump—Test results and observations were made during the development of a pump originally intended for an open-type system employing ethylene glycol as the liquid; thus it was necessary to produce a pump that would circulate the desired quantity of fluid at all altitudes without the aid of pressure, if possible. An investigation was undertaken to ascertain the factors controlling the rate of flow at various altitudes. One of the tests was run with varying coolant temperatures, the pump inlet pressure being reduced to the lowest possible value by the use of a vacuum on the system.

With the pump employed, it was possible to approach within about 2.5 in. of mercury of the vapor pressure of the liquid or about 20-25 deg of the boiling point of the fluid. Subsequent improvements to the design enabled these values to be reduced to about ½ in. of mercury. (See Fig. 1.)

The vapor pressure of commercial glycol at 250 F is approximately 7.0 in. of mercury. This corresponds to about 35,000-ft altitude; thus in an open system 35,000 ft would represent the greatest height that could be expected without applying pressure.

Pump Impeller—The design of the impeller has considerable influence on the results. The following designs were considered:

1. Forward-curving-vane impeller.
2. Radial-vane impeller.
3. Backward-curving-vane impeller.

As a result of tests the first was definitely eliminated, its performance both at sea level and altitude being very poor. In the case of the second type, for a given diameter and speed, a higher delivery pressure and flow at sea level was obtained compared with the

turn to p. 50

third type, but this type of impeller possessed a distinct drooping characteristic under altitude conditions; in addition, its efficiency was lower than the third type. Thus, this type of pump could be recommended for a pressurized system where altitude effects do not enter to a great extent.

The third type of impeller gave the best all-round performance for an open-type system, its sea-level delivery was slightly below that of the second type, but its altitude characteristic was quite good. As a result, it was decided to experiment with a backward-curved vane to find what changes would improve its altitude characteristic. Eventually, by using a backward-curved vane in cooperation with the features discussed below in an approximately circular casing, the delivery characteristic at altitude became that of curve *C* of Fig. 1.

Exit Area of Impeller—Experiments were also conducted upon the effect of varying the area of inlet and exit of the impeller. For the range of sizes possible in the space available, the exit area had the most effect upon altitude delivery. The performance at both sea level and altitude showed a continuous increase up to the maximum values tried. Finally, an impeller having an exit area some 72% greater than the total inlet area, the maximum that could be employed in the castings available, gave improved performance over any smaller exit areas.

Auxiliary Impeller—Effect of fitting the pump impeller with a small propeller-type auxiliary to reach down into the pump inlet was investigated, the result being shown by curves *C* and *D* of Fig. 1. Further experiment is warranted, since the propeller employed was a straight vane as shown in Fig. 2, and the use of a properly designed blade may produce considerable improvement in the result.

Shrouded Impeller—By addition of a shroud to the open face of the impeller, a small gain was contributed to performance at low inlet pressures, though the major gain was an improved efficiency.

Discussion of results—By the use of the various factors given above, it was possible to produce a coolant pump having an altitude characteristic as shown by curve *D* of Fig. 1. This pump incorporated an approximately circular casing and a backward-curved shrouded vane impeller having a greater area at exit than inlet plus a two-vane auxiliary impeller. This combination resulted in:

1. A delivery of over 50% of sea-level flow when the pressure at pump inlet was within about 0.25 in. of mercury of the vapor pressure of the circulating liquid.
2. Delivered 90% of sea-level quantity up to an altitude of 34,500 ft.
3. Sea-level flow was maintained to an altitude of 25,000 ft.

Apart from establishing that it is possible to design a coolant pump having a straight-line delivery characteristic at varying altitudes when fitted to an open-type coolant system, the work outlined in this paper is perhaps of chief interest due to its divergence from accepted theory, which indicates that:

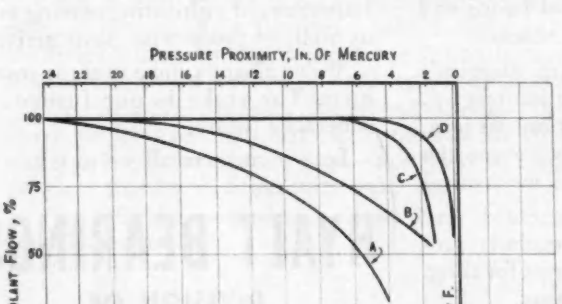
1. Velocity of water leaving the impeller should be converted into pressure through the use of a volute.
2. The exit area of an impeller should be smaller than the inlet.
3. The relative and absolute velocity at entrance and exit of an impeller are related by the conventional vector diagrams.

With regard to No. 1, the test results using concentric and volute casings machined as concentric as possible showed in all cases a marked improvement in both pressure and quantity at both sea level and high altitude, accompanied with improved efficiency, so much so that considerable doubt is entertained regarding the validity of No. 1 in the generally accepted theory.

Again in No. 2 the actual results obtained by violating the laws of continuity of flow showed such marked improvement that it could not be accidental.

With regard to the vector diagrams, these were used in the normal manner for the design of the original pump. Later in the experiments very careful analysis of the velocities, vane angles, and so on, was made when setting out the impeller design, and in all cases these pumps were dismal failures compared with those developed to produce the results shown above.

It might be concluded that the existing centrifugal pump theory is considered to be incorrect, but this is not intended. The theory is based on Bernoulli's equation of continuity of flow, and perhaps a pump would behave as the theory indicates if continuity existed. It is believed that the differences arise from the fact that nothing approaching continuity of flow exists in a liquid that is so rapidly changing velocity, direction, and so forth. Eddies of large dimensions can exist so that passages do not run full.



■ Fig. 1 – Pump delivery characteristics – curves *A* and *B* show the change in performance with a circular casing employing radial vanes; curve *C* was obtained with a circular casing plus a backward-curved vane in place of the radial; for curve *D*, an auxiliary impeller was added to the pump represented by curve *C*

■ Fig. 2 – Complete coolant pump

The work outlined presents one method of producing a coolant pump to deliver at a constant rate of flow up to the approximate existing critical altitudes of aircraft engines. It is seen that under extreme altitude the vapor pressure of the coolant is approached very closely, thus for future engines having higher critical altitudes a closed system becomes necessary. The variables that exist are sufficiently numerous that it is believed a different solution of the problem could be worked out.

Discussion

Replying to Earle A. Ryder, Pratt & Whitney Aircraft, Mr. Vincent explained that the area of the volute casing was not changed, only the cut-water was machined away. When this was done, about the same results were obtained as when the circular casing finally used was tested.

When the inlet temperature was measured, the heater was on the exit side, and there was considerable turbulence between the point of heat application and the point where temperature was measured. The results seemed to check satisfactorily.

The author's remarks that theory does not work out very well in the practice of pump design brought on a good-natured discussion from the floor. Bernard J. Gaffney, U. S. Industrial Chemicals, Inc., told of one instance where theory doesn't work out. A coolant of high specific heat and low viscosity does not necessarily mean that such a coolant will be better than one of lower specific heat and higher viscosity. A. P. Fraas, Packard Motor Car Co., also emphasized that we can't depend too much on theory in pump designing.

Mr. Vincent contributed that according to theory one should be able to get 50-psi pressure, but he has been able to get only about half this figure.

In answer to a question from the audience, Mr. Vincent explained that results were reproducible within the experimental error of the apparatus, if temperatures are properly held to the correct figures.

S. K. Hoffman, chairman of the session, said that tests at Lycoming with backward-curving vanes and shrouded impeller pretty much substantiated Mr. Vincent's results.